تلخيص لاب فيزياء 1

شرح التجارب +حل جميع أسئلة السنوات

للطالبة :ضحى صالح
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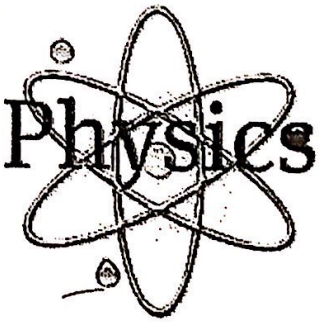


الجامعة الهاشمية+الأردنية

Name of Experiment :

Exp 1: Collection and Analysis of Data

Exp 2: Measurement and Uncertainties

Exp 3: Vectors & Force Table

Exp 4: Kinematics of Rectiliner Motion

Exp 5: Force and motion

Exp 6: Collision in Two dimensions

Exp 8: Simple harmonic motion . simple pendulum

Ex P9: The Behavior of Gases with changes in Temp. and pressure

Exp 11: Specific heat Capacity of metals.

*بالإضافة إلى :

Experimetal Error and Data Analysis. (المقدمة)

Introduction

المقدمة ....

Experimental Error and data Analysis.

ملاحظة : - يجب دراسة جميع صفحاتها ثم الدخول للتجارب .

physics Lab (1)

Experimetal Error and data Analysis: المقدمة

1 Empirical relations

مفهوم عام

طريقة حل سؤال إيجاد العلاقة الرياضية:

1- نعوض في معادلة الخط المستقيم

$$y = mx + b$$

- y: الشيء الموجود (الرمز) على محور الصادات
- x: الشيء (الرمز) الموجود على محور السينات
- m: slope الميل ← $\frac{\Delta y}{\Delta x}$ ← فرق الصادات / فرق السينات
- b: y-int ⇐ التقاطع مع محور الصادات.

2- نضع أساس e مع في حالة الـ "Ln"

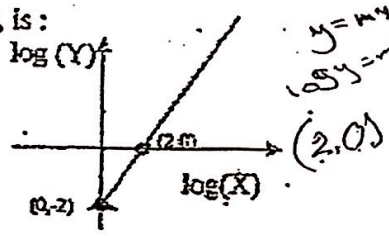
10 مع في حالة الـ "Log"

3 نطرح e او 10 ← نحول (+) ← نحول (×) * نحول الجمع إلى ضرب

نحول (−) ← نحول القسمة إلى (0/0) *

2) The empirical relation which describes the plotted curve, is :

a) Y = 100 X
b) Y = 2X
c) Y= X/100
d) Y= 100- X²



$y = mx + b$
$\log y = m \log x + b$

* نحل حسب الخطوات .

Solution :

$y = m x + b$

$\log y = \text{slope} * \log(x) + (-2)$

* يجد إيجاد الـ slope : من الرسمة أخذ نقطتين

$(0, -2) \;/\; (2, 0)$
$(x_1, y_1) \;/\; (x_2, y_2)$

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - -2}{2 - 0} = \frac{2}{2} = 1$$

⇒ نعوض في المعادلة ⇒ $\log y = 1 \log x - 2$

2 نرفع الأساس 10 للطرفين ⇒ $10^{\log y} = 10^{(\log x - 2)}$

$y = \frac{10^{\log x}}{10^2}$ ⇒ $y = \frac{x}{100}$ ← ج

هو الجواب

Ex2: which of following empirical relations describes the plotted curve in Fig.1:

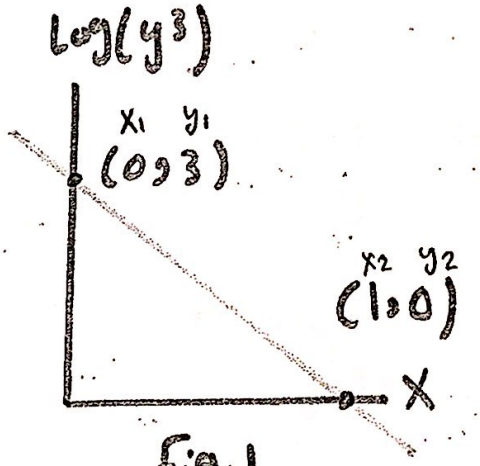


Fig.1

* Solution:

$y = mx + b$

$m \rightarrow$ slope $\Rightarrow \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-3}{1-0} = \frac{-3}{1} = -3$

$* \Rightarrow y = mx + b$

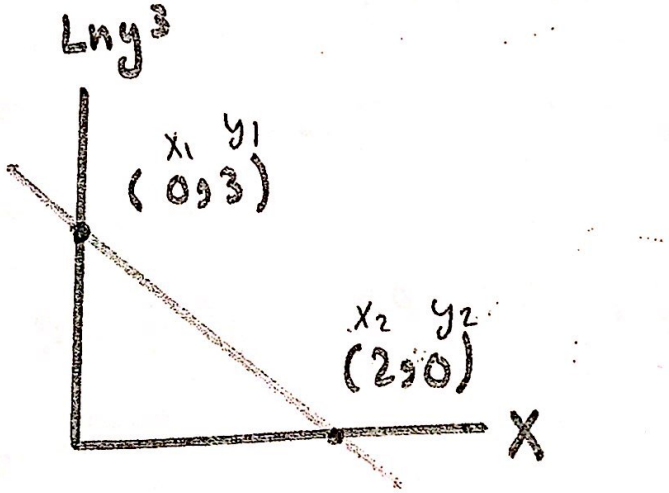
$\Downarrow$

$\log y^3 = -3x + 3$

$\underline{2} \Rightarrow 10^{\log y^3} = 10^{-3x+3} \Rightarrow y^3 = 10^{-3x} * 10^3 \Rightarrow \sqrt[3]{y^3} = \sqrt[3]{\frac{10^3}{10^{3x}}}$

$\Rightarrow y = \frac{10}{10^x}$

Ex3: Find the empirical relation describes the plotted curve in fig: "



Solution:

* slope $\Rightarrow m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-3}{2-0} = \frac{-3}{2}$

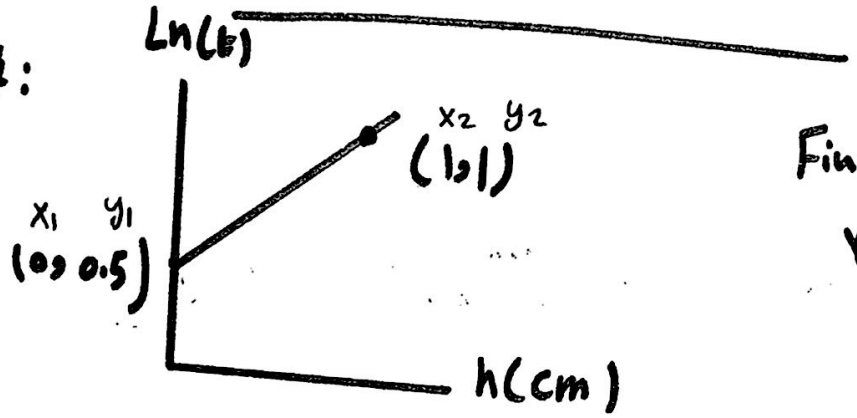
$\Rightarrow y = mx + b$

$\ln y^3 = \frac{-3}{2}x + 3$

$\Rightarrow e^{\ln y^3} = e^{3 - \frac{3}{2}x} \Rightarrow y^3 = \frac{e^3}{e^{\frac{3}{2}x}}$ ⇒ نأخذ الجذر التكعيبي للطرفين ⇒

$y = \frac{e}{e^{x/2}} \Rightarrow$ $y = e * e^{-x/2}$

Ex4:



Find the empirical relation: ?!

Solution: * slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 0.5}{1 - 0} = 0.5$

* $y = mx + b$

$\ln(t) = 0.5h + 0.5$

* $e^{\ln(t)} = e^{0.5h + 0.5}$

* $t = e^{0.5h} * e^{0.5}$ ⇒ $t = e^{0.5h} * 1.643$

Ex 5:

2. Given that $y = \sqrt[3]{x}$, where y and x are variables. If you plot log(y) versus log(x) to get a straight line, then the y-intercept will be:

(a) 3 (b) 1
(c) 1/3 (d) zero

* solution: $y = \sqrt[3]{x}$

$\Rightarrow\Rightarrow \quad y = x^{\frac{1}{3}}$ * نبدخل اللوغاريتم على الطرفين

$\Rightarrow \log y = \log x^{\frac{1}{3}}$

$\Rightarrow \log y = \frac{1}{3}\log x$

المطلوب في السؤال : y-intercept

نقارن المعادلة في الأعلى مع معادلة الخط المستقيم

* $y = mx + b$
* $\log y = \frac{1}{3}\log x + 0$

$\boxed{b = 0}$ الجواب d Zero

2- Given that ($Z = k\,x^n$) where k and n are constants. If you plot (log Z) versus (log x) to get a straight line, then the y-intercept is:

a) log n b) k c) n d) log k

$Z = k x^n$

$\log Z = \log(k x^n)$

$\log Z = \log k + n \log x$

$\log Z$ = y, $\log k$ = y-intercept, n = slope, $\log x$ = x

$R \pm \Delta R$

رح أيجي عليه سؤال على الميد
وسؤال على الفايننل #

خمس (5) حالات وإيادها سيتم توضيح كل حالة وطرح أسئلة السنوات كل منها:

١ حالة الضرب والقسمة ← يكون معطى علاقة في السؤال مع القيم ولنس الخطأ.

٢ حالة طرح وجمع لخطيات

٣ حالة الدمج ← حالة وجود (خطي) بطرف وجمع أو طرح (وقوة أو قسمة أو ضرب) بطرف آخر

← أو وجود (قوة أو ضرب وقسمة) في حدين يفصل بينهم جمع أو طرح

٤ حالة حفظ القوانين

٥ اكتشاف تجارب

سيتم توضيح كل حالة:

* الحالة الأولى:

✓ يكون معطينا علاقة فيها ضرب أو قسمة أو ضرب مع قسمة أو ضرب مع قسمة مع أس.

✓ لكي نقوم بال إيجاد ΔR نقوم بمباشرة في العلاقة

✓ لكي نجد ΔR نطبقه على القانون التالي:

$$\Delta R = R\sqrt{\left(\frac{F_1 \Delta x}{x}\right)^2 + \left(\frac{F_2 \Delta y}{y}\right)^2 + \dots}$$

R: وهي القيمة التي أوجدناها

F_1 = قوة المتغير الاول

Δx = نسبة الخطأ للمتغير x

x = قيمة المتغير. [6]

Ex #]

6- Calculation of errors:

If $R=XY^3$

$X \pm \Delta X = 2 \pm 0.03$

$Y \pm \Delta Y = 1.5 \pm 0.01$

find $R \pm \Delta R =$

$R \pm \Delta R$

Solution $\Rightarrow$ $R = xy^3 \Rightarrow R = (2) * (1.5)^3 = 6.75$

$$\Rightarrow \Delta R = R\sqrt{\left(\frac{F_1 \Delta x}{x}\right)^2 + \left(\frac{F_2 \Delta y}{y}\right)^2} = 6.75\sqrt{\left(\frac{1 * 0.03}{2}\right)^2 + \left(\frac{3 * 0.01}{1.5}\right)^2}$$

$\Delta R = 0.16875$

$\Rightarrow R \pm \Delta R = 6.75 \pm 0.16875$

Ex #]

If $z=x^3/y$, where x and y measured in the experiment, then the uncertainty in z is:

(a) $\Delta z = \sqrt{\left(\frac{3\Delta x}{x}\right)^2 + \left(\frac{\Delta y}{y}\right)^2}$

(b) $\Delta z = z\sqrt{\left(\frac{3\Delta x}{x}\right)^2 + \left(\frac{\Delta y}{y}\right)^2}$

(c) $\Delta z = z\sqrt{3\left(\frac{\Delta x}{x}\right)^2 + \left(\frac{\Delta y}{y}\right)^2}$

(d) $\Delta z = z\sqrt{\left(\frac{\Delta x}{x}\right)^2 + \left(\frac{\Delta y}{y}\right)^2}$

$z = x^3/y \Rightarrow \Delta z = z\sqrt{\left(\frac{3 * \Delta x}{x}\right)^2 + \left(\frac{1 * \Delta y}{y}\right)^2}$

لـ الطالبة الأول

الجواب ط هـ

Please circle the correct answer:

1) Given that $R = 2XY - 5$, and: $X \pm \Delta X = 2.3 \pm 0.1$, $Y \pm \Delta Y = 6.5 \pm 0.1$, then the value of $\Delta R / R$ is equal to:

a) 0.05 b) 1.38 c) 0.69 d) 0.09

$R = 2xy - 5$

لا

ملاحظة هذا السؤال يحل في الحالة الاولى ولا يتغير من حالات الدمج الأن العمود في الطرف الآخر مجهول ثابت (5)

* $\frac{\Delta R}{R}$ ؟؟ ⇒ المطلوب

نعلم أن ⇒ $\Delta R = R \sqrt{\left(\frac{f_1 \Delta x}{x}\right)^2 + \left(\frac{f_2 \Delta y}{y}\right)^2}$ نقسم الطرفين على R

$$\Rightarrow \frac{\Delta R}{R} = \sqrt{\left(\frac{1 * 0.1}{2.3}\right)^2 + \left(\frac{1 * 0.1}{6.5}\right)^2} = 0.046 \approx 0.05$$

الجواب a

* ملاحظة اذا طلب في السؤال حساب R فيحسب بالطريقة الاتية :

⇒ $R = 2XY - 5$

⇒ $R = 2 * (2.3)(6.5) - 5$

⇒ $R = 24.9$

الحالة الثانية : حالة جمع وطرح القطبيات :

* اذا كان المطلوب $R \pm \Delta R$

كانت المعادلة المعطاة في السؤال : $R = F_1 A - f_2 B$ (طرح أو جمع)

فإنه تعويض مباشر في المعادلة . $R \pm \Delta R$ هي $\sqrt{(F_1 \Delta A)^2 \pm (F_2 \Delta B)^2}$

دائماً جمع بغض النظر عن المعادلة الرئيسية .

ملاحظة : هذه الحالة لم ترد عليها أسئلة سنوات لنا سيتم ذكر مثال للتوضيح فقط :

$x \pm \Delta x \equiv 3 \pm 0.03$

$y \pm \Delta y \equiv 6 \pm 0.1$

$R = 6x - y$

Find $R \pm \Delta R$:

$R = 6x - y$

$\Rightarrow R = 6*(3) - 6 = 18 - 6 = 12$

$\Rightarrow \Delta R = \sqrt{(6 * 0.03)^2 + ((-1) * 0.1)^2} = 0.2$

12 ± 0.2

الحالة الثالثة : حالة الدمج : — وجود (قطبي) في طرف (وقوة أو ضرب وقسمة) في طرف آخر يفصل + أو

— وجود قوة أو ضرب وقسمة في جهة يفصل بينهما جمع أو طرح .

← في حالة الدمج دائماً نقوم بالفرض حتى نرجع المسألة للحالات السابقة ذكرها .

14) Given that $R = 6x - \frac{2y}{z^2}$ with $x \pm \Delta x = 3 \pm 0.03$, $y \pm \Delta y = 6 \pm 0.1$ and $z \pm \Delta z = 9 \pm 0.05$ then ΔR equals:

a) 0.81
b) 2.87
c) 0.18
d) 3.22

* ΔR?? المطلوب

$R = 6X - \frac{2y}{Z^2}$ → مقسمة مع قوة

طرح | مضروب

عليه قوة

*:. اضافي حالة ٣ (حالة الدمج):

* دائماً في مثل هذا النوع من المسائل نقوم بالفرض بحيث إنو أرجع مسألتي لأحد الحالات السابقة

$R = 6x - \frac{2y}{z^2}$ → $B = \frac{y}{z^2}$ نأخذه بلا معاملات

هون بنوجد $B \pm \Delta B$ (وهي في الحالة الأولى)

$\Rightarrow B = \frac{y}{z^2} \Rightarrow$ هاي على الحالة الأولى

$B = \frac{6}{(9)^2} = \frac{6}{81} = 0.074$

$\Delta B = B\sqrt{\left(\frac{1 * \Delta y}{y}\right)^2 + \left(\frac{2 * \Delta z}{z}\right)^2}$

$\Delta B = 0.074\sqrt{\left(\frac{0.1}{6}\right)^2 + \left(\frac{2 * 0.05}{9}\right)^2}$

$\Delta B = 0.001$

$B \pm \Delta B = 0.074 \pm 0.001$

يتبع

*نرجع للمعادلة الأصلية

$$*R = 6X - 2\frac{y}{z^2}$$

$$\Rightarrow R = 6X - 2\beta \Rightarrow$$ هيل رجعنا للعلاقة (٢)

$$R = 6*(3) - 2*(0.074)$$

$$R = 17.852$$

$$\Delta R = \sqrt{(6\Delta X)^2 + (2\Delta B)^2} = \sqrt{(6*0.03)^2 + (2*0.01)^2} = 0.18$$

$\Delta R = 0.18$ ⟵ الجواب ج

الحالة الرابعة : حالة حفظ القوانين

سيتم طرح القوانين المطلوبة وعمل ثم حل أسئلة عليها :

الكرة

For a sphere:

① $V = \frac{4}{3}\pi r^3 \equiv V = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3$

تعريف الرموز:

- V: Volume (الحجم)
- r: radius (نصف القطر)
- d: diameter (القطر)

② $\rho = \frac{m}{V} \equiv \rho = \frac{3m}{4\pi r^3} \equiv \rho = \frac{6m}{\pi d^3}$

تعريف الرموز:

- ρ: density (الكثافة)
- m: mass (الكتلة)
- V: Volume (الحجم)
- r: radius (نصف)
- d: diameter (القطر)

③ $\frac{A}{b} = 4\pi\frac{r^2}{b}$

Area (مساحة) radius

2] for a cylinder →

1] $V = \pi h r^2 \equiv V = \pi h \left(\frac{d}{2}\right)^2$

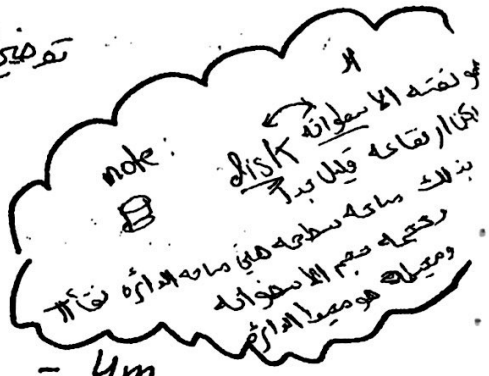
V: Volume الحجم

h: hieght الارتفاع

r: radius

d: diameter

توضيح للرموز



2] $\frac{C}{T} = \pi \cdot \frac{d}{T}$

C: circumference (المحيط) — T: diameter (القطر)

3] $\rho = \frac{m}{V} = \frac{4m}{h\pi d^2}$

4] $A_t = 2\pi r (h + r)$ لإيجاد المساحة الكلية للأسطوانة

3] momentum (الزخم) ⇒ momentum = Velocity * mass

الزخم = السرعة * الكتلة .

4] Cube: المكعب ⇒ $V = A^3$ (V: Volume، A: طول الضلع)

حجم المكعب = (طول الضلع)^3

5] square: المربع : $C = 4(A)$ (C: محيط المربع، A: طول الضلع)

6] circle / disk دائرة

$C = \pi d$

$A = \pi \left(\frac{d}{2}\right)^2$

$V_{disk} = \pi h \left(\frac{d}{2}\right)^2$

$A = (B)^2$ (A: المساحة، $(B)^2$: (طول الضلع)^2)

مسألة

12] 1) A student measures the length of a cube side to be 3.4±0.1 cm, then the volume of the cube V±ΔV (in cm^3) will be:

a) 39.3±5.55 b) 79.5±5.55 c) 79.5±3.47 d) 39.3±3.47

Solution: الحالة الرابعة لأنها تربط علاقة رياضية :

Cube → $V = A^3$ ⇒ $V \pm \Delta V$

$V = A^3$

$V = (3.4)^3$

$V = 39.3\ cm^3$

$\Delta V = V\sqrt{\left(\frac{F\,\Delta A}{A}\right)^2} = 39.3\sqrt{\left(\frac{3 * 0.1}{3.4}\right)^2} = 3.46$

12

[Ex 13]

3. A student measures the following dimensions for a cylindrical rod. He found that the diameter and height of rod; $(6.2\pm0.01\ mm)$ and $(15.3\pm0.01\ cm)$, respectively. If the mass of rod is $(16.36\pm0.01\ g)$, then the value of $\Delta\rho/\rho$ will be:

(a) 0.033
(b) 0.847×10^{-3}
(c) 0.003
(d) 9.347×10^{3}

Solution: هذا السؤال على العلاقة 4 لأنو طالبنا أوجد علاقة : المطلوب $\frac{\Delta\rho}{\rho}$ والشكل Cylinder

نعلم $\Rightarrow \rho = \frac{4m}{h\pi d^2}$

ونعلم $\Rightarrow \frac{\Delta\rho}{\rho} = \frac{\rho}{\rho}\sqrt{\left(\frac{1*\Delta m}{m}\right)^2+\left(\frac{1*\Delta h}{h}\right)^2+\left(\frac{2*\Delta d}{d}\right)^2}$

$\Rightarrow \frac{\Delta\rho}{\rho} = \sqrt{\left(\frac{1*0.01}{16.36}\right)^2+\left(\frac{1*0.01}{15.3}\right)^2+\left(\frac{2*0.01}{6.2}\right)^2}$

$\Rightarrow \frac{\Delta\rho}{\rho} = 3.347*10^{-3} = 0.00334 \approx \boxed{0.003}$ ← الجواب = ج

ملاحظة مهمة جداً : π = الباي = 3.14 يتم اعتبارها ثابت كأي عدد اذا لم تعطَ صيغتها في السؤال على شكل $\pi\pm\Delta\pi$ أمّا اذا أعطى error تحتسب وتعوض في قانون $\Delta\rho$ مثلاً ...

[Ex 14]

3. The diameter, height and mass of a cylinder are $d\pm\Delta d=(0.610\pm0.005)cm$, $(h\pm\Delta H=(11.3\pm0.1)cm$ and $m\pm\Delta m=(16.83\pm0.01)g$, respectively. The density $(\rho\pm\Delta\rho)$ (in g/cm^3) of the cylinder is:

a) 5.099 ± 0.061
b) 5.644 ± 0.068
c) 5.099 ± 0.095
d) 5.644 ± 0.105

Solution: cylinder $\Rightarrow \rho\pm\Delta\rho$??

$\Rightarrow \rho = \frac{4m}{h\pi d^2} = \frac{4*16.83}{11.3*3.14*(0.610)^2} = 5.0988 \approx 5.099$

$\Rightarrow \Delta\rho = \rho\sqrt{\left(\frac{1*0.01}{16.83}\right)^2+\left(\frac{1*0.1}{11.3}\right)^2+\left(\frac{2*0.005}{0.610}\right)^2} = 0.095$ ← الجواب = ج

15.

In order to determine the area of circular disc, a student measured the diameter (d) to be $3.2 \pm 0.1 cm$. The value of $A \pm \Delta A$ (in cm^2) will be:

(a) 8.04 ± 0.50
(b) 4.15 ± 0.50
(c) 4.15 ± 0.36
(d) 8.04 ± 0.36

$A_{disk} = A_{circle}$

$\Rightarrow A = \pi \left(\frac{d}{2}\right)^2 \Rightarrow A = \pi \left(\frac{3.2}{2}\right)^2 = 8.0384$

$\Rightarrow \Delta A = A \sqrt{\left(\frac{2\,\Delta d}{d}\right)^2} \Rightarrow 8.0384 \sqrt{\left(\frac{2 * 0.1}{3.2}\right)^2} = 0.5024$

$A \pm \Delta A \Rightarrow 8.0384 \pm 0.5$ فرع a

الطريقة الخامسة : اخطاء سلسلة تجارب :

اذا أعطى السؤال حدة تجارب وطلب $R \pm \Delta R$

$R \Longrightarrow R = \left(\frac{\text{مجموع القيم}}{\text{عددهم}}\right)$ * نجد المتوسط الحسابي

$\Delta R \Longrightarrow \sqrt{\sum_{n=1}^{n} \frac{(R - \overline{R})^2}{N(N-1)}}$

$\overline{R}$: المتوسط الحسابي

R_0 : أحد القيم من السؤال

N_0 : عدد مرات ايراد التجربة

Σ : sum (المجموع)

Ex 16

7) A series of measurements made to determine π. The results were: 3.11, 3.12, 3.13, 3.14 and 3.15. The value of $\pi \pm \Delta\pi$ will be:

a) 3.14±0.007 b) 3.13±0.006 c) 3.14±0.006 (d) 3.13±0.007

* هذا السؤال في الحالة الخامسة لازم اعطي دقة بجاربه

$\overline{\pi} \pm \Delta\overline{\pi}$??

$$\Rightarrow \overline{\pi} = \frac{\sum \text{القيم}}{N} = \frac{3.11+3.12+3.13+3.14+3.15}{5} = 3.13$$

$$\Rightarrow \Delta\overline{\pi} = \sqrt{\sum_{n=1}^{n} \frac{(\pi - \overline{\pi})^2}{N(N-1)}} =$$

$$\Rightarrow \Delta\overline{\pi} = \sqrt{\frac{(3.11-3.13)^2+(3.12-3.13)^2+(3.13-3.13)^2+(3.14-3.13)^2+(3.15-3.}{5(5-1)}}$$

$$\Rightarrow \Delta\overline{\pi} = 7.071 * 10^{-3} = 0.007$$

$$\Rightarrow \overline{\pi} \pm \Delta\overline{\pi} = (3.13 \pm 0.007) \quad \text{الجواب } \underline{d}$$

Ex 17)

4- Five measurements of the volume of object are (3.15, 3.2, 3.16, 3.18, 3.15) the mean value of the volume (V) is:

d) 3.15 (c) 3.17 b) 3 a) 3.16

Solution: $V = \frac{3.15+3.2+3.16+3.18+3.15}{5} = 3.168 \approx 3.17$

Ex 18)

A- Five measurements of the volume of a disk (diameter, d and thickness, t) were made. Let the fractional errors in d and t be A (i.e. $A = \Delta d/d$) and B (i.e. $B = \Delta t/t$) respectively. Then the fractional error in the volume is:

a- $(4A+B)^{1/2}$ b- $4A^2+B^2$

(c) $(4A^2+B^2)^{1/2}$ d- (A^2+B^2)

Solution: $\frac{\Delta d}{d} = A$ / $\frac{\Delta t}{t} = B$

*fractional error in V ⇒ $\frac{\Delta V}{V}$?? V_{disk} = الاسطوانة

$\Rightarrow \Delta V = \pi h \left(\frac{d}{2}\right)^2$

(has t) في السؤال

$\Rightarrow \frac{\Delta V}{V} = \sqrt{\left(\frac{\Delta h}{h}\right)^2 + \left(\frac{2\Delta d}{d}\right)^2}$

$\frac{\Delta V}{V} = \sqrt{(B)^2 + 4(A)^2}$

$\frac{\Delta V}{V} = (4A^2 + B^2)^{1/2}$

---

3 Personal error

دايماً بيأتي عليه سؤال إما ميد أو فايتل

* هنالك ٣ حالات لإيجاد Personal error

١ توجد قيمة حقيقية (accepted value) وقيمة من التجربة (experimental)

٢ لا توجد قيمة حقيقية وتوجد قراءتين من التجربة

٣ لا توجد قيمة حقيقية وتوجد أكثر من قراءة من التجربة

شرح الحالات:

١ قيمة حقيقية مع قيمة من التجربة:

$P.E = \frac{|\text{القيمة الحقيقية} - \text{التجربة}|}{\text{القيمة الحقيقية}} * 100\%$

19) 3- A cylindrical object is measured to have a diameter d of 5.25 cm and a circumference c of 16.38 cm. If the accepted value of π is 3.14, the percent error in the experimental value of π is (2 marks)

a) 6% b) 0.06% c) 0.02% d) 0.6% e) 0.02%

Solution: $d = 5.25$, $c = 16.38$ ⇒ $c = \pi . d \Rightarrow \frac{c}{d} = \pi \Rightarrow \pi = \frac{16.38}{5.25}$

16

$\pi_{exp} = 3.12$
$\pi_{acce} = 3.14$

$$P.E = \frac{|\text{القيمة المقبولة} - \text{القيمة التجريبية}|}{\text{القيمة الحقيقية}} * 100\%$$

التوسع غير مطلوب لوجود اشارة القيمة المطلقة

$$\Rightarrow P.E = \frac{|3.12 - 3.141|}{3.14} * 100\% \Rightarrow 0.636\%$$

فرع (d) الجواب.

---

2. لا توجد قيمة حقيقية وتوجد قراءتين فقط لنفس التجربة :

أيضاً التوسع غير مطلوب لوجود اشارة القيمة المطلقة !!

$$P.E = \frac{|\text{الأولى} - \text{الثانية}|}{\left(\frac{\text{مجموعهم}}{2}\right)} * 100\%$$

eg 22/ $\pi = 3.14$ ، $\pi = 3.12$ ، experimental Value ، Find the Percen error?

Solution : نلاحظ أن القراءتين ناتجان عن تجربة ولم يذكر أن أحد القيمتين accepted * اذن هي الحالة 2

$$P.E = \frac{|3.14 - 3.12|}{\left(\frac{3.14 + 3.12}{2}\right)} * 100\% = \frac{0.02}{3.13} * 100\% = 0.63$$

---

3. لا توجد قيمة حقيقية وتوجد أكثر من قراءة

$$P.E = \frac{|\text{أكبر قراءة} - \text{أصغر قراءة}|}{\left(\frac{\text{مجموعهم كلهم}}{\text{عددهم}}\right)} * 100\%$$

Ex 23] $\pi = 3.12$, $\pi = 3.13$, $\pi = 3.14$ experimetal Value ، find the P.E

هنا نظر أكثر من قراءتين اذن حالة 3

$$P.E = \frac{|3.14 - 3.12|}{\left(\frac{3.12 + 3.13 + 3.14}{3}\right)} * 100\% = \frac{0.02}{3.13} * 100\% = 0.638\%$$

[Ex 20]

A cylindrical object is measured to have a diameter $d = 3.52cm$ and a circumference $c = 12.19cm$. If the accepted value of π is 3.14, the percent error in this experimental value of π is:

(a) 4.4%
(c) 4.9%
(b) 10.2%
(d) 9.2%

نفس فكرة مثال 21 ص 77

Example 0.8:

[21] What is the percent difference between two measured values of 4.6 cm and 5.0 cm ?

Solution: With $E_1 = 4.6$ cm and $E_2 = 5.0$ cm,

لحا ماينذكر في السؤال أنه أحد القيم accepted

بالتالي هي القيم وادات التجربة

* اذن في هذا المثال احنا بالحالة رقم 2

$$\text{percent difference} = \frac{|E_2 - E_1|}{(E_2 + E_1)/2} \times 100\%$$

$$\text{percent difference} = \frac{5.0 - 4.6}{(5.0 + 4.6)/2} \times 100\%$$

$$= \frac{0.4}{4.8} \times 100\% = 8.3\%$$

[1] Experimental error and data analysis:

Types of error:

Experimental errors can be generally classified as being of three ty

1 Personal error 2 systematic error 3 Random error

1 Personal error:

Some times Called: illegitimate errors (اسم آخر)

مسألة ٩: د. محمود

* Personal error arises from personal bias (التحيز) or carelessness (عدم الاهتمام) in reading an instrument, in recording observations, or in mathematical calculation.

Examples of personal errors: (personal error) (B) (مثالين على الـ)

في القيام بالتجربة عدة مرات

ايضا المشاهد سوف يتحيز لأخذ النتيجة التجربة الأولى وليس المعدل للتجارب

1 In performing a series of measurements an observer may become biased in favor of the first observation.

2 Errors in reading a scale: شرحها: Reading a value from a scale involves lining up an object with the marks on the scale. The apparent distance between two objects, and hence the value of the reading (مقدار التغير عن القيمة الأصلية ويعتمد على), depen on the position of the other, or when the head is moved from side to side (horizontal scale) or up and down (vertical scale). This apparent change in position due to a change in the position of the eye is called **Parallax**. For example: The different is viewed from above or below a line of sight perpendicular to scale. (Fig 0.1) Also when measuring length with a meter stick placed flat against the object the thickness of the meter stick placed flat against the object the thickness of the meter stick holds the scale about 0.7 cm from the object, and readings may vary considerably due to Parallax (fig 0.1)

الرسمة تحت الصفحة مهمة

errors in reading a scale

حفظ أسباب الخطأ في قراءة التدرج (سببين) و معنى parallax و الصورة ١٫٠١

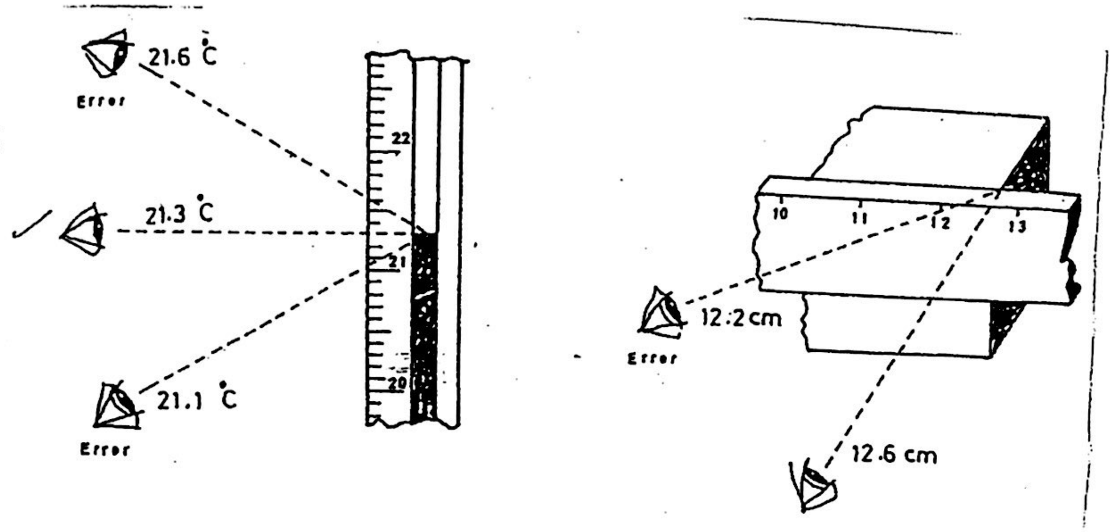


Fig (0.1) Examples of personal error in reading a scale due to parallax: هو النظر لقراءة المسطرة بشكل غير افقي horizontal
بسبب
بل بزاوية

مهم: parallax هو من أسباب ال personal error ومعناه

2/ Systematic error:

هو الخطأ الذي يكون بسبب الأداة نفسها

* systematic errors are errors associated with particular measurement instruments or techniques, such as an improperly calibrated instrument or bias on the part of the observer. Conditions from which systematic errors can result include:

امثلة

ان تكون الأداة غير موضوعه على القراءة (صفر) بالبداية مثل الميزان

1. An improperly "Zeroed" instrument (eg: a balance or ammeter)

ان يقيس ميزان الحرارة درجة الغليان للماء 101 وهي بالأصل 100°

2. A thermometer that reads 101°C when immersed in boiling water at standard atmospheric pressure. The therinometer is improperly calibrated since the reading should be 100°C

(personal & systematic errors)

التحيز لأخذ قراءة التجربة الأولى وعدم أخذ المعدل للتجارب (هذه النقطة مكررة)

3. Personal bias of an observer, who, for example, always takes a low reading of a scale division. Thus, a personal error may be a systematic error

تمر في قراءة أداة بسبب عوامل بيئية (بحيث تقرأ أعلى)

4. A meter stick that has shrunk due to environmental conditions would always read higher

RANDOM error: ⟶ م: أي خطأ ناتج من البيئة المحيطة مثلاً درجة الحرارة والضغط الجوي

3// Random errors result from unknown and unpredictable Variations in experimental situations. Random errors are also referred to as accidental errors and are sometimes beyond the Control of the observer. Conditions by which random errors can result include:

خارجة عن تحكم الذي يقوم بالتجربة

مهم حفظ الأمثلة على كل نوع errors #

1: Unpredictable fluctuations in temperature or Line Voltage

2: Mechanical vibrations (اهتزازات) of the experimental setup

3: Un biased estimates of measurement readings by the observer

---

له أنواع الأخطاء يأتي عليها سؤال واضح في الميد وسؤال في الفاينل - ليس دائماً -

---

* 2 Physics Quantity:

ح كميات قياسية (مقدار فقط)

1 Scalar Quantity : time, distance, mass, speed, temprature, ..

2 Vector quantity : displacement, velocity, acceleration, ..

له كميات متجهة (لها مقدار واتجاه)

---

* 3 Accuracy and Precision

مو الدقة ... ومو الدقة

The Value له ... له error

* في البداية سيتم توضيح (Accuracy) و (precision)

ومعرفة أن 2B أمثلة حل عليها

Example 0.2: المثال

Two independent experiments give two sets of data with the expressed resul and uncertainties of 2.5 ± 0.1 cm and 2.5 ± 0.2 cm, respectively. The first resu is more precise than the second because the spread in the first measurements between 2.4 and 2.6 cm, whereas the spread in the second measurements between 2.3 and 2.7 cm. That is, the measurements of the first experiment a less uncertain than those of the second.

The **accuracy** of an experiment depends in general on systematic errors. Tl **precision** of an experiment depends on random errors.

* إذن اذا أظهر السؤال الفيزياء وطلب :

more accurat

هنا نقارن الأرقام المعطاة بالقيمة الحقيقية

more precise

ننظر إلى ما بعد $(\pm)$ والأقل هي الجواب الصحيح * أي الأصغر *

ننظر إلى الدقة قبل $(\pm)$ فالأقرب إلى القيمة الحقيقية يكون الجواب

مثال على أنواع الأخطاء :

من الحفظ للاختبار

Which of the following is an example of a random error ?
a) Improperly zeroed instrument
b) Fluctuation in temperature
c) Using an old meter stick
d) None of the above

answer: b

ملاحظة : كل تجربة لها نوع من الأخطاء وسيتم ذكرها عند كل تجربة منها ...
وهناك أمثلة على الخطأ في الصفحات الأخيرة في المقدمة

7- Two independent experiments give two sets of data for earth acceleration "g" with the expressed results and uncertainties of 9.8±0.5 and 9.7±0.1 m/s^2. Respectively.(the accepted value of $g=9.8ms^{-2}$)

(2 marks)

a) The accuracy and the precision of the second experiment is better than the first.
b) The accuracy and the precision of the first experiment is better than the second.
c) The second experiment is more precise than the first.
d) The first experiment is more precise than the second.
e) The second experiment is more accurate than the first.

* توضيح للسؤال وطريقة حله :

First experiment ← 9.8 ± 0.5
second experiment ← 9.7 ± 0.1

← معطينا نتائج تجربة

لا يعبروا عن سنة الخطأ .

← وقيمة القيمة الحقيقية للجاذبية الأرضية $g=9.8 m/s^2$

← وبعدها سألنا عن علاقة على الترتيب.

Solution:

more accurate

① * 9.8 ± 0.5
② * 9.7 ± 0.1

العوابل more accurate

* g = 9.8

كما وضحنا سابقاً نقارن الرقم اللي قبل (±) بالقيمة الحقيقية والأقرب الها هو الجواب

9.8
9.8

الأقرب والصحيح

9.7
9.8

الأبعد

2B

more precise

① * 9.8 ± 0.5
② * 9.7 ± 0.1 → more precise

* g = 9.8

كما وضحنا سابقاً نقارن الأرقام اللي بعد (±) والأقل هي الجواب

0.5 ⊐ 0.1

الأقل

∴ هي الجواب

*second exp more precise

كمس الضغاث ١٧

(2:

1. In order to obtain the value of gravitational acceleration (g), two students computed the following results ($g_1 = 10.0 \pm 0.02\ m/s^2$, $g_2 = 9.7 \pm 0.2\ m/s^2$), if the accepted value is ($g = 9.8\ m/s^2$) then:

a) Two students have the same accuracy, but student one is more precise.
b) Two students have the same precision, but student two is more accurate.
c) Student one is more precise and less accurate than student two.
d) Student two is more precise and more accurate than student one.

توضيح السؤال : نفس فكرة Ex1 :

$g_1 = 10.0 \pm 0.02$

$g_2 = 9.7 \pm 0.2$

$g = 9.8\ m/s^2$ ⇒ accepted Value (القيمة الحقيقية)

Solution:

more accurate

$*g_1 = 10.0 \pm 0.02$

$*g_2 = 9.7 \pm 0.2$ → more accurate

$g = 9.8$

↓

± قابل

g_1	g_2
10.0	9.7
9.8	9.8

↓

الأقرب للقيمة الحقيقية

g_2 more accurate than g_1

more precise

$g_1 = 10.0 \pm 0.02$

$g_2 = 9.7 \pm 0.2$

$g = 9.8$

↓

± فاقد

$0.02 < 0.2$

↓

الأصغر

g_1 more precise than g_2

اذن الجواب C *

Student One is more precise and less accurate than Student two

24

(What's the major error of the exp) : مهم حفظ أسباب الخطأ في كل تجربة ونوع الخطأ

1 تجربة : Measurments and uncertainties + تجربة + Collection and analysis of data

سبب الخطأ : error in calculations and measurments

نوع الخطأ : personal error

2 تجربة : Force and motion + تجربة + Force table

سبب الخطأ : frictional force

نوع الخطأ : systematic error

3 تجربة : gas Laws

سبب الخطأ : changing in temprature

نوع الخطأ : Random error

4 تجربة : Heat capacity

سبب الخطأ : Lost heat to surrounding

نوع الخطأ : Random error

5 تجربة : Simple pendolum

سبب الخطأ : error in calculating the time period / θ is very big

نوع الخطأ : personal error

note

في حال كان السؤال the major error of

- inaccuricy → إذا: systematic
- precision → إذا: Random

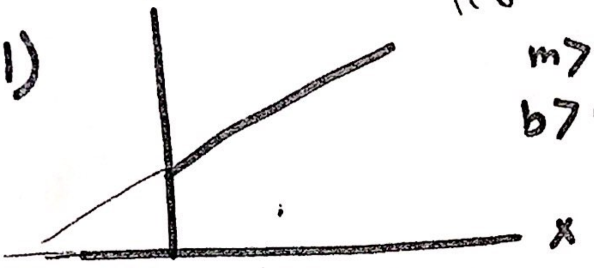
تجربة : Kinamatic & Rectiliner motion

سبب الخطأ : personal error

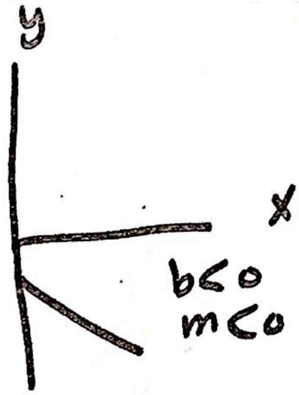
نوع الخطأ : we must move the paper with an Avg speed not high or low

الاقتران الخطي (أشكاله)

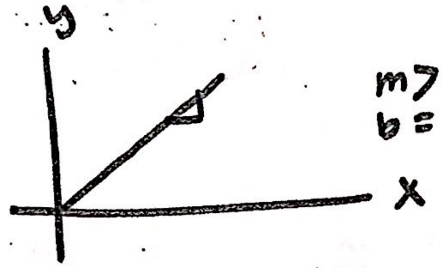
(($y = mx + b$))

1)


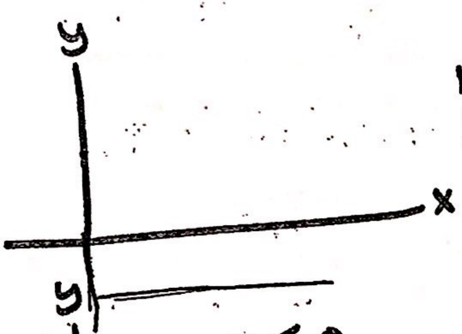
$m > 0$
$b > 0$

⑦


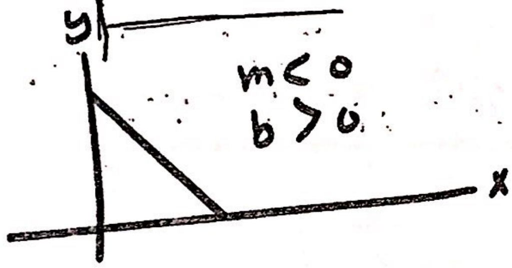
$b < 0$
$m < 0$

2)


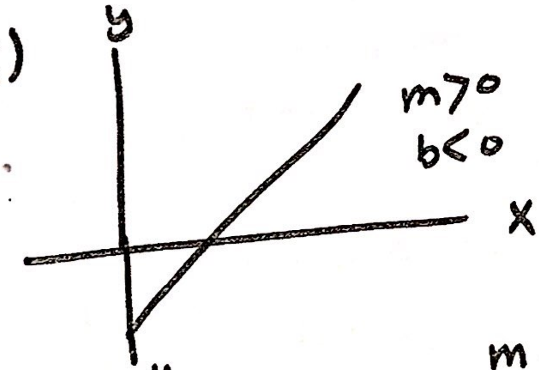
$m > 0$
$b = 0$

3)


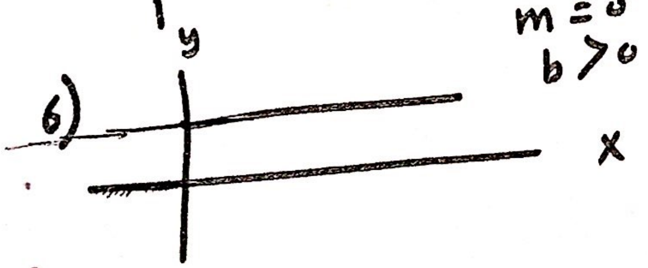
$m = 0$
$b < 0$

4)


$m < 0$
$b > 0$

5)


$m > 0$
$b < 0$

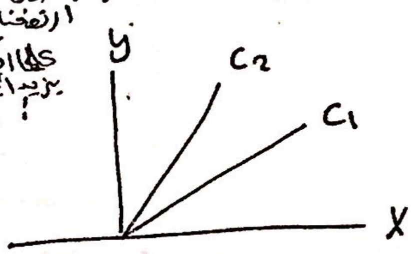
6)


$m = 0$
$b > 0$

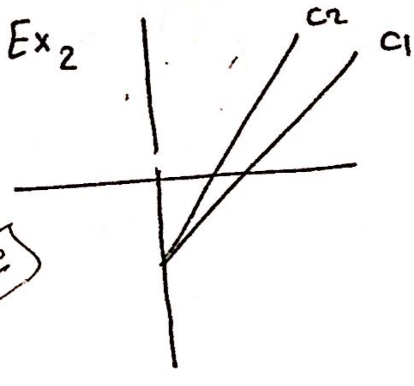
notes:

بالنسبة للميل في الربع الاول كلما ارتفعنا يزداد .
اما في الربع الرابع كلما ارتفعنا يقل .
او بالأحرى كلما نزلنا للاسفل يزيد

$b > 0 \Rightarrow$ كلما ارتفعنا يزيد الميل
$b < 0 \Rightarrow$ كلما انخفضنا يزيد الميل

Ex1 :


$c_2 > c_1$

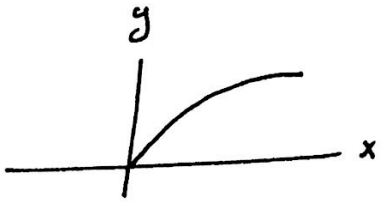
Ex2


$c_1 > c_2$

$C \equiv$ ميل

هذه الرسمات مهمة جداً جداً لجميع تجارب المادة فسوف نحتاجهم
لاشتقاق رسمات جميع التجارب #

* الاقتران الجذري: $y = b\sqrt{x}$ (الصيغة العامة)



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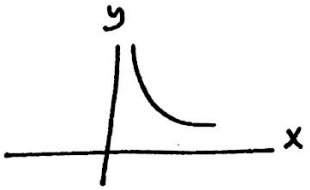
* الاقتران العكسي:

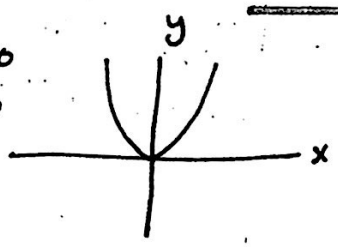


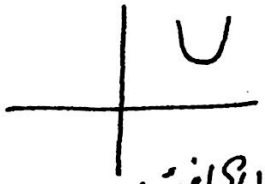
الصيغة العامة: $y = \frac{m}{x^2} + b$

OR $y = \frac{m}{x}$ نفس الرسمة ✗

---

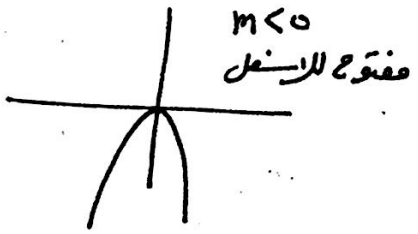
* الاقتران التربيعي: $y = mx^2 + b$





$\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

لـ نقطة رأس القطع المكافئ.



Introduction

Ex1) Given that $R=\frac{x^3}{10yz}$ with $x\pm\Delta x=4\pm0.01$, $y\pm\Delta y=5\pm0.02$ and $z\pm\Delta z=10\pm0.1$, then ΔR equals: **2 Marks**

(a) 15.2×10^{-5}
(b) 19×10^{-5}
(c) 13×10^{-4}
(d) 16.8×10^{-4}

$$\Delta R = R\sqrt{\left(\frac{3\Delta X}{X}\right)^2+\left(\frac{\Delta y}{y}\right)^2+\left(\frac{\Delta z}{z}\right)^2}$$

$$\Delta R = 0.128\sqrt{0.000056+0.00016+0.0001}$$

$$= 0.00167 = 16.8*10^{-4}$$

Ex2 ❖ **Error Analysis:**

12) If $X\pm\Delta X=10\pm0.1$, $Y\pm\Delta Y=30\pm0.5$ and $Z\pm\Delta Z=15\pm0.2$, then the magnitude of error in R for the following relation is;

$$R=Y-X/Z^2$$

a) 0.017
b) 0.004
c) 0.510
d) None of the above

$$\Delta R=\sqrt{(\Delta y)^2+(\Delta B)^2}$$

$$=\sqrt{(0.5)^2+(0.00125)^2}$$

$$=0.500001$$

none الجواب

$B=\frac{X}{Z^2}$ نفرض

$$\Delta B = B\sqrt{\left(\frac{\Delta X}{X}\right)^2+\left(\frac{2\Delta z}{z}\right)^2}$$

$$=0.044\sqrt{0.0001+0.00071}$$

$$=0.00125$$

Ex $R=y-3X^2$

Find ΔR

$x\pm\Delta x = 2.32\pm0.01$

$y\pm\Delta y = 1.16\pm0.02$

$$\Delta R=\sqrt{(\Delta y)^2+(3\Delta B)^2}$$

$$=\sqrt{(1.16)^2+(3\times0.046)^2}$$

$$=0.139$$

$B=X^2$

$$\Delta B = B\sqrt{\left(\frac{2\Delta X}{X}\right)^2}$$

$$=2.32\times(2\times0.01)$$

$$=0.046$$

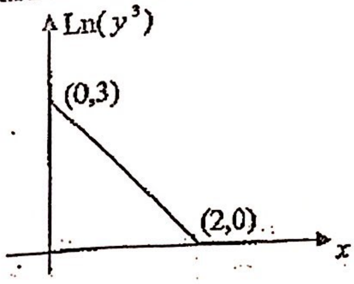
Ex₃ 3) The correct empirical relation that describes the plotted curve in graph is: **2 Marks**

(a) $y = e^{1-x^2}$

(b) $y^2 = e^{1-x^3}$

(c) $y = e^{3-3x}$

(d) $y = e^{1-x/2}$



$y = mx + b$

$\ln y^3 = \frac{3}{-2}x + 3$

e للطرفين $\Rightarrow$ $y^3 = e^{\frac{-3}{2}x+3}$

~~$y = e^{\frac{-3}{...}}$~~ $(y = e^{\frac{-x}{2}+1})^2$?

$y = e^{\frac{-}{}x+2}$

Ex₄ 2) Given the function $y = c10^{2mx}$, where c and m are constants. The value of m may be determined from a graph of: **2 Marks**

(a) y versus x | **(b) log(y) versus x** ✓
(c) log(y) versus log(mx) | (d) log(y) versus log(x)

لإيجاد m من خلال ال slope & ال y-intercept :

$\log y = \log c10^{2mx}$ نجرب ونضع Log للطرفين

$\log y = \log c + \log 10^{2mx}$

$\log y = \log c + 2mx$

($\log y$ ↓ y, $2m$ ↓ slope, x ↓ x)

لذلك الإجابة الصحيحة b

فاينل الصيفي الاول+الثاني لسنة 2016

EX1 given that $R = (3x+2y)/(y-x)$ then ΔR is given by:

$R = \frac{A}{B}$ — الحل: هذه حالة الدمج نسميها كل علامة نرمزله اسم

$A = 3x+2y$ — أولاً

$B = y-x$

$$\Delta R = R\sqrt{\left(\frac{\Delta A}{A}\right)^2 + \left(\frac{\Delta B}{B}\right)^2} = R\sqrt{\left(\frac{\sqrt{(3\Delta x)^2+(2\Delta y)^2}}{(3x+y)}\right)^2 + \left(\frac{\sqrt{(\Delta y)^2+(\Delta x)^2}}{y-x}\right)^2}$$

وهذه ليست موجودة بالخيارات وبذلك **none of the above**

فاينل الصيفي الاول+الثاني لسنة 2016

EX2 the diameter of a sphere was measured four times the measurments are 2.40 cm, 2.35 cm, 2.48 cm, 2.38 cm

Find the area of the sphere surface $(A \pm \Delta A)$ in cm^2

$d =$ المتوسط $= \frac{2.48+2.4+2.35+2.38}{4} = 2.3825$

$A_{sphere} = \pi\left(\frac{d}{2}\right)^2 = 3.14 * \left(\frac{2.38}{2}\right)^2 = 4.49\ cm^2$

$\Delta A = A\sqrt{\left(\frac{2\Delta d}{d}\right)^2} = A * \frac{2\Delta d}{d}$

$= \frac{4.48 * 2 * 0.0005}{2.3825}$ ← من الحفظ

$= 1.8 * 10^{-3} = 0.0018$

none of the above — بالخيارات — 4.48 ± 0.0018 — الجواب

ميد الصيفي الاول لسنة 2016

EX3 In force table experiment the error caused by the friction force between pulley (بكرة) and strings is considered as:

(a) personal error **(b) systematic error** ← من الحفظ

(c) Random error (d) analytical error

ميد الصيفي الاول سنة 2016

EX4 Two experiments where done to find the value of the acceleration due to gravity. The results are $g_1 = 9.7 \pm 0.52\ m/s^2$, $g_2 = 9.3 \pm 0.21\ m/s$ then:

الاجابة الصحيحة **(a) g_1 is more accurate but g_2 is more precise**

EX5 Which of the following is not systematic error?

Examples

(a) Improperly zeroed instrument

(b) Vibration in the experimental setup

(c) The Thermometer is improperly calibrated since the reading should be 100C°

(d) A student always takes a Low reading of a scale division

Random errors

EX6 A room whose Length is measured to be 12.75 ± 0.005 m and whose width is measured to be 3.64 ± 0.001 m Find the area and the error in the area of the room $(A \pm \Delta A)$ in m^2.

$$A = \text{Length} * \text{width}$$
$$= 12.75 * 3.64$$
$$= 46.41 \ m^2$$

$$\Delta A = A\sqrt{\left(\frac{\Delta L}{L}\right)^2 + \left(\frac{\Delta W}{W}\right)^2}$$
$$= 46.41\sqrt{\left(\frac{0.005}{12.75}\right)^2 + \left(\frac{0.001}{3.64}\right)^2} = 0.022$$

$(46.41 \pm 0.022) m^2$

EX7 given that function $y = c\,10^{mx}$, where m and c are constants, the value of m may be determined from the graph of:

(a) y versus X

(b) Log y versus X

(c) Log y versus Log(mx)

(d) Log y versus Log X

EX8 Two students made an experiment to measure the gravitation acceleration, The first one had $g_1 = 10.0 \pm 0.5 \ m/s^2$ and g_2 9.8 $\pm$ 0.2 m/s^2 which of the following statements best describes these results:

Student two is more precise and more accurate than student one

EX9 ميد النصل الفصل الثاني لسنة 2016

$R = y - 3x$

$x \pm \Delta x = 2.32 \pm 0.01$

$y \pm \Delta y = 1.16 \pm 0.02$

Find ΔR

الحل ⇒ طريقة الثانية

$$\Delta R = \sqrt{(\Delta y)^2 + (3\Delta B)^2}$$

$$= \sqrt{(0.02)^2 + (3 \times 0.046)^2}$$

$$= \underline{0.139}$$

#

$B = x^2$, x^2

$$\Delta B = B\sqrt{\left(\frac{2\Delta x}{x}\right)^2}$$

$= 2x\Delta x$

$= 2 * 2.32 * 0.01$

$= 0.046$

EX10 ميد الفصل الثاني 2016

A student measured the following values of the radius (R) of a circle in cm. They were $r = 1.08, 1.18$ and 1.02. Find the error in the measured radius in (cm)

$$\bar{r} = \frac{1.08 + 1.18 + 1.02}{3}$$

$$= 1.08$$

$$\Delta r = \sqrt{\frac{\sum_{n=1}^{\infty} (r - \bar{r})^2}{N(N-1)}}$$

$$= \sqrt{\frac{(1.08 - 1.08)^2 + (1.18 - 1.08)^2 + (1.02 - 1.08)^2}{3(2)}}$$

$$= 0.0281$$

#

EX11 ميد الفصل الثاني لسنة 2015

$R = \frac{x^2}{2yz}$

$x \pm \Delta x = 2.32 \pm 0.02$

$y \pm \Delta y = 2.45 \pm 0.01$

$z \pm \Delta z = 3.65 \pm 0.05$

then $\Delta R / R = ??$

$$\frac{\Delta R}{R} = \sqrt{\left(\frac{2\Delta x}{x}\right)^2 + \left(\frac{\Delta y}{y}\right)^2 + \left(\frac{\Delta z}{z}\right)^2}$$

$$= \underline{0.335}$$

#

EX12 ميد الفصل الثاني 2016 + ميد الفصل الأول لسنة 2015

The independent variable in an experiment is:

(a) the variable you hope to observe in an experiment

(b) the variable you change in an experiment

(c) The variable that isn't changed in an experiment

(d) none of these is correct

EX13 A student obtained the following values of the radius (r) of a circle in cm. He obtained r = 2.13, 2.14, 2.15, 2.16 and 2.17

2015

the error in the measured radius Δr (in cm) is :

$$\Delta r = \sqrt{\frac{\sum_{m=1}^{\infty} (r - \bar{r})^2}{N(N-1)}}$$

$$\bar{r} = \frac{2.13 + 2.14 + 2.15 + 2.16 + 2.17}{5} = 2.15$$

$$= \sqrt{\frac{(2.13-2.15)^2 + (2.14-2.15)^2 + (2.15-2.15)^2 + (2.16-2.1 + (2.17-2.15)^2}{5(4)}}$$

$$= \sqrt{5 * 10^{-5}} = 7.071 * 10^{-3} = 0.007071 \approx 0.0071$$

EX14 Depending on the previous question. If the true value of radius is 2.11 cm, the persent error in the radius of the circle in (cm) is :

$$\text{P.E} = \left| \frac{\bar{r} - r_{accepted}}{r_{accepted}} \right| * 100\% = \left| \frac{2.15 - 2.11}{2.11} \right| * 100\%$$

$$= 1.89\%$$

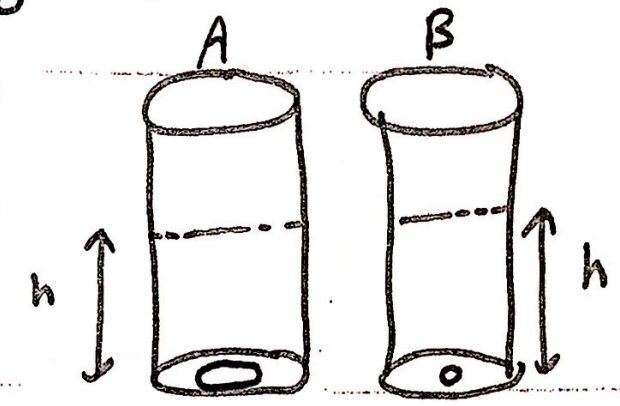
#

Experiment (1)

Collection and Analysis of Data

Exp: Collection and analysis of data :

توضيح :



→ نفس ارتفاع الماء $h_A = h_B$

→ الوعاء A القطر له أكبر من الوعاء B

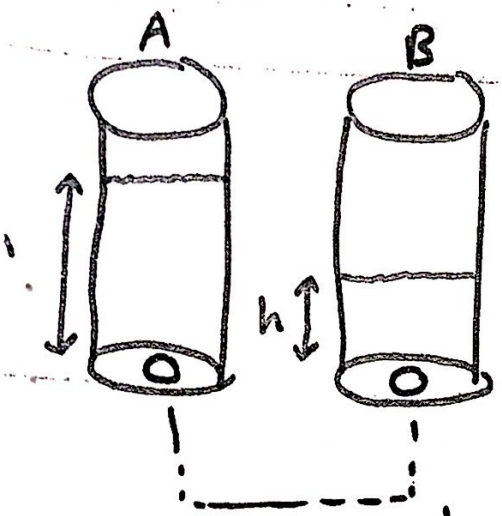
$d_A > d_B$

→ الوعاء A ← القطر له اكبر بالتالي سيقل الزمن اللازم لتفريغ الوعاء ..

* $t \propto \frac{1}{d}$ (العلاقة عكسية)

ملاحظة :

d: diameter :	القطر
h: height :	الارتفاع



* نفس القطر $d = d$

* الوعاء A ارتفاع الماء h فيه اكثر من الوعاء B

* سنلاحظ أننا فرغ الوعاء A سنحتاج إلى زمن اكبر لإفراغه

* اذن كلما زاد ارتفاع الماء زاد الزمن المستغرق لتفريغ الوعاء

* $t \propto h$

(العلاقة طردية)

* قوانين خطأ :

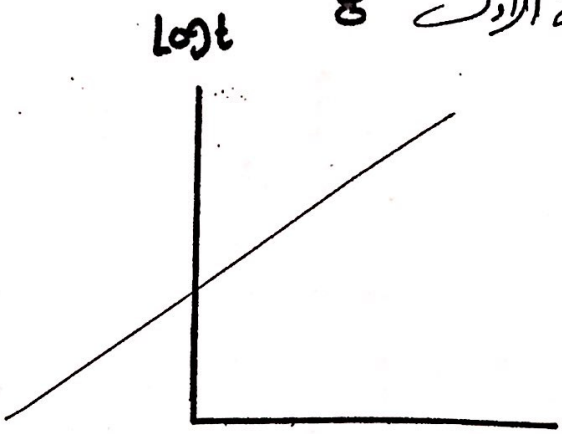
$$t = 10^{b} h^{m}$$

t: time : الزمن : (sec) الوحدة

b: y-int ⇒ التقاطع مع محور الصادات

h: height ⇒ الارتفاع ⇒ الوحدة cm

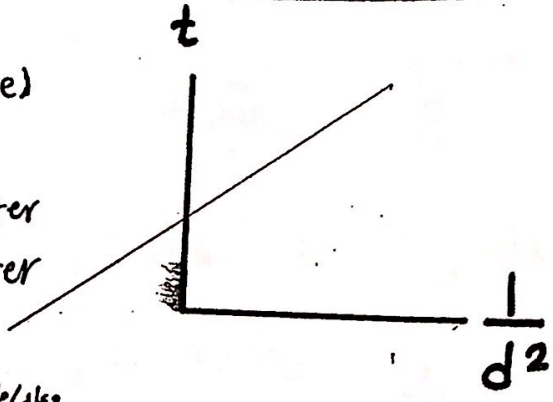
* الرسمة اللي بنستخدم فيها القانون الأول & واعطاء h =



---

2 $t = \frac{m}{d^2} + b$

& t: time (se)
& m & slope
& d & diameter
& b & y-inter



تفريغ — وعاء/طريقة

Ex 26

2. The time needed to empty a container filled with water depends on its height for a certain hole diameter as shown in *fig.1* below. According to that, if the height of water was 7dm, then the time needed to empty the same container is:

a) 10.53sec
b) 7.96sec
c) 1.02sec
d) 0.90sec

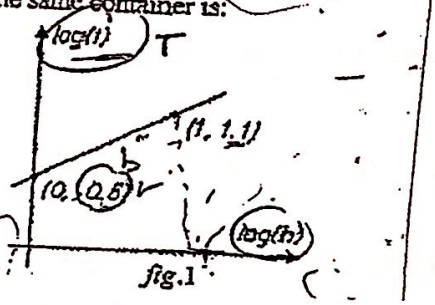


fig.1

Solution:

log t
log h

مباشرة اعطانا رسمة ⇐ نستخدم القانون

$t = 10^b h^m$

$t = 10^{0.6} (7)^{0.5} = 10.532 \text{ sec}$

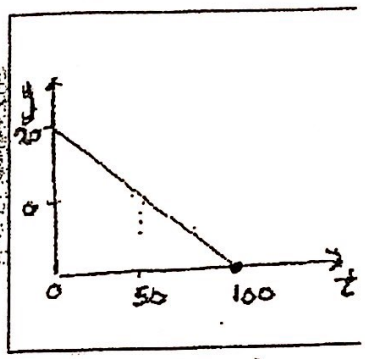
a الجواب فرع

$(x_1, y_1) = (0, 0.6)$
$(x_2, y_2) = (1, 1.1)$

$m \rightarrow \text{slope}: \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1.1 - 0.6}{1 - 0} = 0.5$

Ex 27] **Collection and Analysis of Data:**

1- For the figure shown, (y) as a function of (t) is given by:



b) $20 - 0.2t$ a) $5t + 20$

d) $100 - t$ c) $20 - 5t$

Solution: $y = mx + b$

$y = \text{slope} * t + 20$

$y = -0.2t + 20$

$y = 20 - 0.2t$

slope: (0, 20) (100, 0)

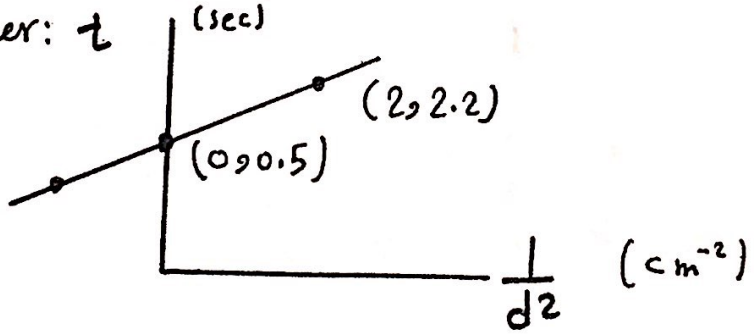
$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 20}{100 - 0} = \frac{-20}{100} = -0.2$

Ex 28] Which of the following statements is correct for the time required to empty the cylindrical container:

a) If d is constant, the time is directly proportional to the height of water.
(b) If h is constant, the time is directly proportional to the diameter of the hole.
(c) If d is constant, the time is inversely proportional to the height of water.
(d) If h is constant, the time is directly proportional to the area of the hole.

الجواب فقرة a كما ذكرنا سابقاً (طردي) بثبوت الـ d (القطر). $t \propto h$

Ex 29] IF the diameter $\Rightarrow d = 5\,cm$, find the time needed to empty the Container:



Solution: نطبق على القانون التالي

$\Rightarrow t = \frac{m}{d^2} + b$

$\Rightarrow t = \frac{0.85}{(5)^2} + 0.5 = 0.534\,s$

$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2.2 - 0.5}{2 - 0} = 0.85$

2- The relation between the time needed to empty container and the depth of the water is given by $t = c\sqrt{h}$ where c is constant. For a certain depth the time needed is 8 sec, if the depth is halved then the time in (sec) needed to empty the container is: (2 marks)

a) 3.45   b) 1.73   c) 4.2   d) 5.6   e) 2.6

$t = c\sqrt{h}$

* $t_1 = 8 sec$, h_1 | t_2 ?? $h_2 = \frac{1}{2} h_1$ → فيدل سؤال

* نقسم المعادلتين :

$\frac{t_2 = c\sqrt{h_2}}{t_1 = c\sqrt{h_1}} \Rightarrow \frac{t_2}{8} = \frac{\sqrt{0.5}\sqrt{h_1}}{\sqrt{h_1}} \Rightarrow \frac{t_2}{8} = \sqrt{0.5} \Rightarrow t_2 = 5.65$

فرع d

ملاحظة

halved : التنصيف ⇒ $h_2 = \frac{1}{2} h$

trippled : *3 ⇒ $h_2 = 3h_1$

one-forth : $\frac{1}{4}$ ⇒ $h_2 = \frac{h_1}{4}$

one-fifth : $\frac{1}{5}$ ⇒ $h_2 = \frac{h_1}{5}$

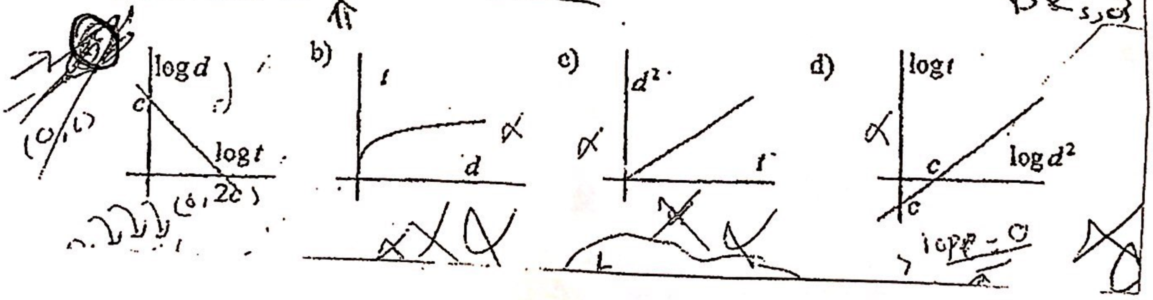
Ex 31] $t = c\sqrt{h}$, when $t_1 = 6 sec$ → h_1 * C is constant, t_2 ??

* $h_2 = 0.5 h_1$??   نفس فكرة سؤال 30

$t_2 = 4.24$ sec ⇐ الجواب بكتابة

---

3. Which of the following graphs is correct to represent the relation between the time (t) and the diameter of the hole (d) on the bottom of the container at constant depth of water?



note

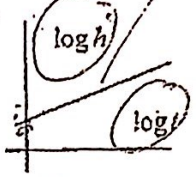
33 / 33 حل مسائل

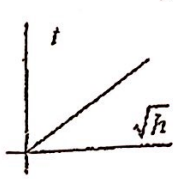
[4]

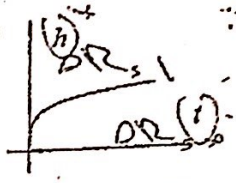
Ex 33]

2. Which of the following graphs is correct to represent the relation between the time (t) and the depth of water (h) in the container at constant area of the hole?

a) t vs h c) t vs $\sqrt{h}$ d) h vs t







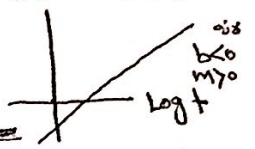
b) $t = b h^{\frac{1}{2}}$

$\log t = \log b + \frac{1}{2}\log h$

$\frac{1}{2}\log h = \log t - \log b$

$\log h = 2\log t - 2\log b$

$\log h = 2\log t - b$



Ex 34]

5-It is found that the relationship between the time t (in sec) of water emptying and height of water level h(in cm), for containers with hole diameter d (in cm) is given by $\log_{10} t + 2\log_{10} d = 0.25$. At what diameter of the hole is the emptying time 7 sec?

0.504 cm.

$\log t + 2\log d = 0.25$

$t = 7$

$d = ?$

$\Rightarrow \log 7 + 2\log d = 0.25$

$\log d = \frac{0.25 - \log 7}{2} \Rightarrow \log d = -0.297 \Rightarrow d = 0.504$ cm

Ex 35]

5- COLLECTION AND ANALYSIS OF DATA :

For the corresponding figure (3), which shows A log relation, find in clear mathematical steps The relation between y and x Such as $y =$

$y = mx + b$

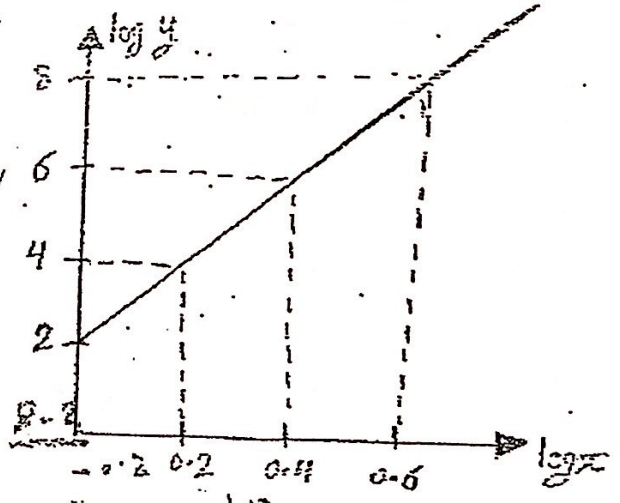
$y = kx^m$

$\log y = \log k + m\log x$

$Y = mX + b$

$\log y = 10x + 2$

$m =$



الحل الصحيح بالخلف

solution: $y = mx + b$

$m: \frac{6-4}{0.4-0.2} = 10$

$\log y = m \log x + 2$

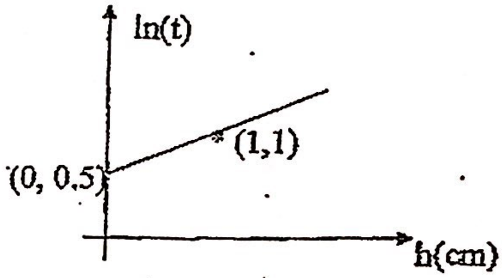
$\log_{10} y = 10 \log_{10} x + 2 \Rightarrow y = x^{10} * 100$

---

(36)

8) In an experiment, a student measures the variation between the height of water (h) in a container and the time needed to empty water from a hole with diameter (d). The correct relation that represents the following figure is:

(a) $t = 1.65\, e^{h/2}$
b) $t = 1.65\, e^{2h}$
c) $t = 7.4\, e^{2h}$
d) $t = 7.4\, e^{h/2}$



Solution:

هذه اختار ضمن المقدمة :

$\Rightarrow y = mx + b$

$\Rightarrow \ln t = m\,h + 0.5$

$\Rightarrow \ln t = 0.5\,h + 0.5$

$\Rightarrow e^{\ln t} = e^{0.5h + 0.5}$

$\Rightarrow t = 1.643\, e^{\frac{h}{2}}$ ※ a الجواب النوع !!

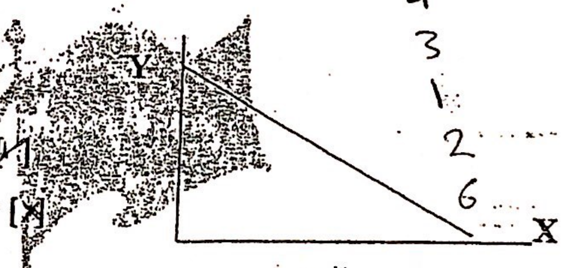
slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-0.5}{1-0} = 0.5$

1- Collection and Data Analysis:

Refer to figure beside

⊛ The relation between y and x is linear [✓] خطية

⊛ The relation between y and x3 is linear [X]

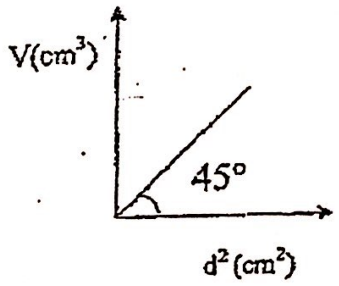


4
3
1
2
6

$y \propto x$

$y = mx + b$ يعني Linear X & Y الواضح من الصورة أن العلاقة خطية بين
دائماً ولو هنا بتجيب القرائما لن تكون خطية مباشرة

4-In an experiment.. to measure the variation of the volume V versus the square of the diameter d^2 of a cylindrical object of constant height h, the graph below is obtain. The heigh h of the cylinders is: 1.27 cm.



$\tan\theta$ ← slope دائماً : ملاحظة

$\frac{\Delta y}{\Delta x}$

* $V_{cylinder} = h\pi\left(\frac{d}{2}\right)^2$

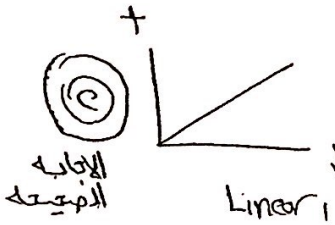
$V = \frac{h\pi d^2}{4} + 0$

$\Rightarrow$ slope $= \frac{h\pi}{4}$ بالمقارنة مع معادلة الخط المستقيم

$\Rightarrow$ slope $= \tan 45$

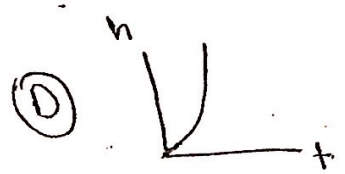
$\frac{h\pi}{4} = \tan 45$

$\frac{h\pi}{4} = 1 \Rightarrow \frac{4}{\pi} = h\pi \Rightarrow \left(h = \frac{4}{\pi}\right)$ cm $\Rightarrow h = 1.27$ cm.



$t = b\sqrt{h}$ (y = b√x)

طريقة حل مثال 33



$t = b\sqrt{h}$

$t^2 = b^2 h$

$h = \frac{1}{b^2} t^2$

$h = m t^2$

هذا القوان تربيعي وبكانه m>0 معناها مفتوح الاعلى

Ex 32

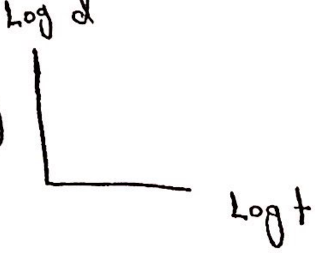
العلاقة بين d و t

نبدأ من عندها

$t = \frac{m}{d^2}$ عكسية

(1)

الإجابة الصحيحة ✓



$t = \frac{m}{d^2}$

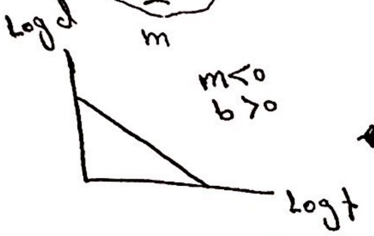
$t \times \frac{m}{d^2} \Rightarrow d^2 = \frac{m}{t} \Rightarrow$

$d^2 = m(t)^{-1} \xrightarrow[\text{العرضي}]{Log} 2 \text{Log } d = \text{Log } m - 1 \text{ Log } t$

(على اقتران)

$\text{Log } d = \frac{\text{Log } m}{2} - \frac{1}{2} \text{Log } t \Rightarrow \text{Log } d = \frac{\text{Log } m}{2} \left(-\frac{1}{2}\right) \text{Log } t$

y-intercept, slope



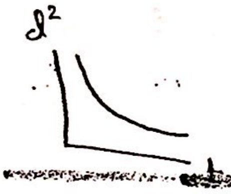
m<0
b>0

الرسمة الصحيحة

(2)

يعني اقتران عكسي

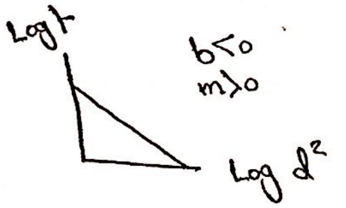
(3)



$t = \frac{m}{d^2} \Rightarrow d^2 = \frac{m}{t}$ (y, x)

علاقة عكسية (اقتران عكسي)

(4)



b<0
m>0

$t = \frac{m}{d^2}$

$\text{Log } t = \text{Log } m - \text{Log } d^2$

y-intercept, slope

Ex1, Which of the following statement is correct for the time required to empty the cylindrical container :

(a) If h is constant, the time is directly proportional to the area of the hole

(b) If h is constant, the time is directly proportional to the diameter of the hole

(c) If d is constant, the time is inversly proportional to the height of the water

(d) If h is constant, the time is inversly proportional to the area of the hole

---

Ex2 which of the following graphs is correct to represent the relation between the time (t) and the depth of water (h) in the container at constant area of the hole!

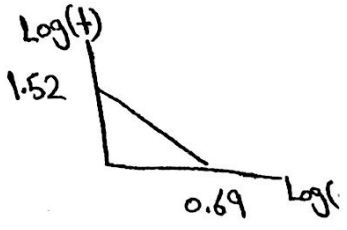
(a) h — t

(b) t — $\sqrt{h}$

(c) Logh — Logt

(d) t — h

Ex3 In collection and analysis of data exp the height of the water is 1cm, the relation between Log(t) and Log(d) is plotted in the figure below, If the diameter of the hole d=2mm, what's the time needed to empty the container?



$\text{Log}\, t = m \text{Log}\, d + b$

$\text{Log}\, t = \text{Log}\, d^m + b$

$t = 10^{\text{Log}\, d^m + b}$

$t = d^m * 10^b$

$t = 2^{-2.202} * 10^{1.52}$

$= 7.18 \text{ sec}$ #

$m = \frac{\Delta y}{\Delta x} = \frac{1.52}{-0.69} = -2.202$

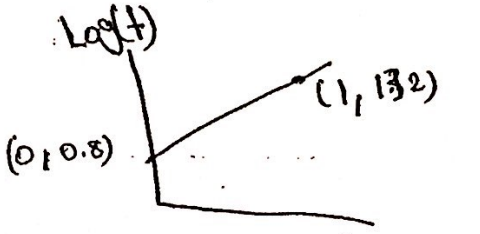
$b = 1.52$

Ex4 For the previos question; the emperical relation between t & d is:

$t = \frac{10^{1.52}}{d^{-2.202}} = \frac{33}{d^{2.2}}$

$\boxed{t = \frac{33}{d^{2.2}}}$

Ex5 the time needed to empty a container filled with water depends on its height for a certain hole diameter as shown in fig1 below. According to that, If the height of the water was 10 cm, then the time (in sec) needed to empty the container is:



emperical relation

$\text{Log}\, t = m \text{Log}\, h + b$

$\text{Log}\, t = 0.52 \text{Log}\, h + 0.8$

$\text{Log}\, t = \text{Log}\, h^{0.52} + 0.8$

$t = 10^{\text{Log}\, h^{0.52} + 0.8}$

$= 10^{\text{Log}\, h^{0.52}} * 10^{0.8}$

$t = h^{0.52} * 10^{0.8} = 10^{0.52} * 10^{0.8} = 20.893$ (10)

$m = \frac{\Delta y}{\Delta x} = \frac{1.32 - 0.8}{1 - 0}$

$= 0.52$

$b = 0.8$

Experiment (2)

Measurments and Uncertainties

Exp2: Measurments and uncertainties

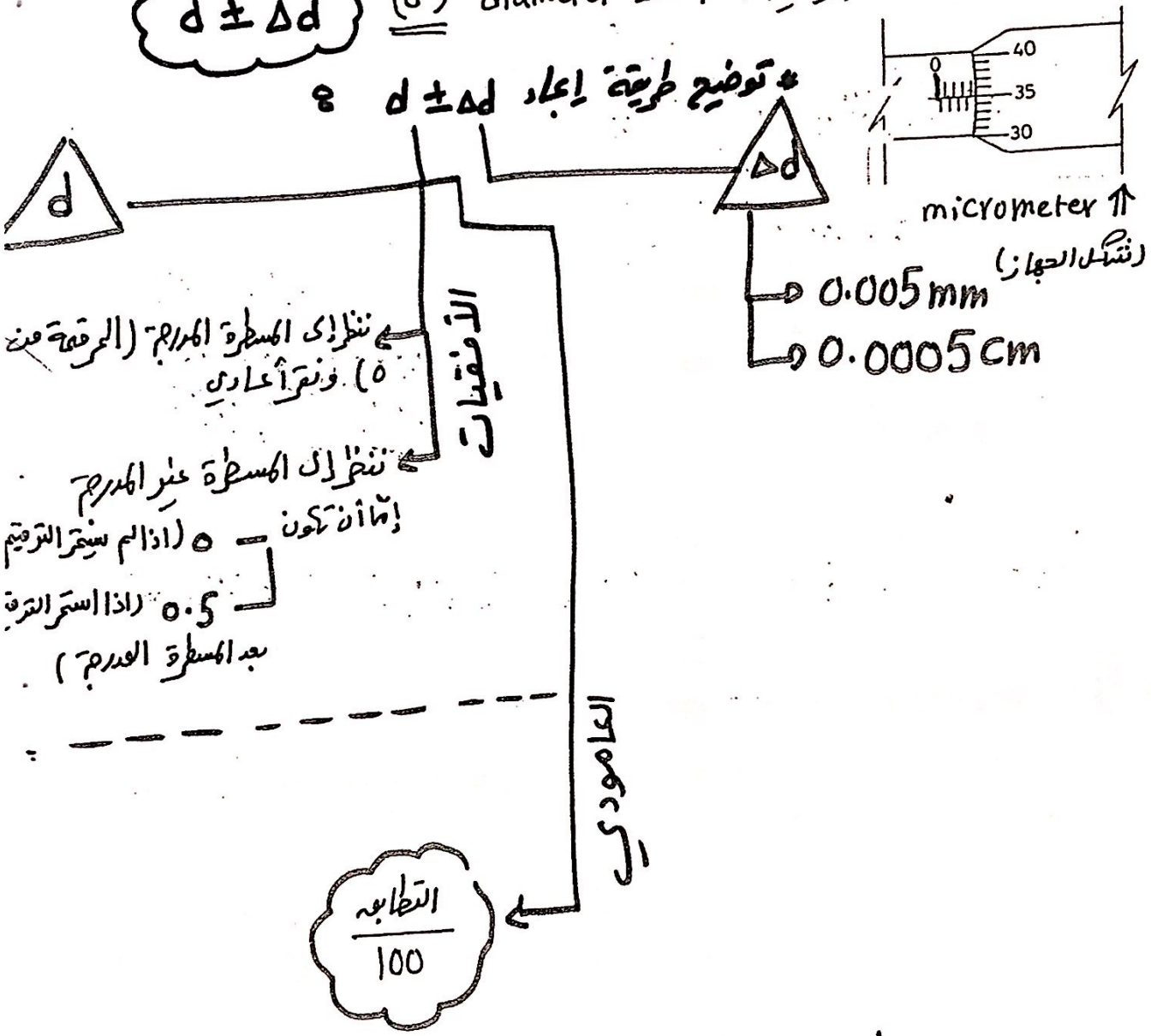
* هذه التجربة ← نوجد d (القطر)
h الارتفاع
⇐ سيتم إيجادهم من خلال جهازين.

الجهاز الاول: 1 Micrometer (الماكرومتر)

* يتم من خلال جهاز الماكرومتر حساب الـ (d) diameter

$d \pm \Delta d$

* توضيح طريقة إيجاد $d \pm \Delta d$ ؟



ملاحظة: $mm \xrightarrow{*10^{-1}} cm$

$cm \xrightarrow{*10} mm$

* متى نضع جهاز micrometer نحن دائما نشكل حرف (T) مقلوباً

[2] Vernier caliper (الورنية)

الجهاز الثاني — $h \pm \Delta h$ — من خلال هذا الجهاز نحسب (height)

* توضيح طريقة الإيجاد:

$h \pm \Delta h$

- Δh → 0.025 mm → 0.0025 cm
- h → في المدرج مع الصفر

* $\left(\frac{\text{أول تطابق}}{10}\right)$ + ننظر إلى الصفر ونأخذ الرقم اللي قبله في غير المدرج *

ملاحظة: القراءة الناتجة بوحدة mm
وإذا طلب نحول
mm $\xrightarrow{*10^{-1}}$ cm

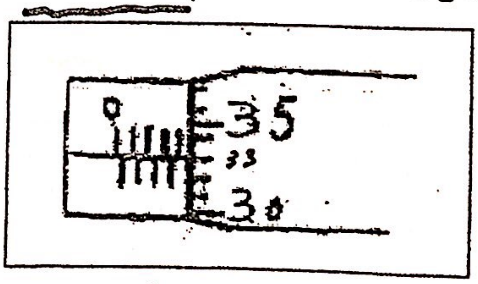
ملاحظة مهمة جداً!
عند إيجاد h ← بالتحديد إيجاد أول تطابق دائماً نأخذ الرقم اللي يكون من جهة التدريج

*ملاحظة: حتى نميز جهاز الورنية ← يكون ع شكل مسطرة (———) خط مستقيم

Ex 37 ⊛ **Measurements and Uncertainties:**

3- The diameter of a sphere was measured by the micrometer shown in the figure, the reading (in mm) is:

a) 4.33 (circled) b) 5.33
c) 4.44 d) 4.48



ذكر في السؤال أن الجهاز (micro) دائماً / ─┤

Solution: $4 + \frac{0}{} + \frac{33}{100} = 4.33$ الفرع a الجواب

- 4 ← قراءة المسطرة المدرج
- 0 ← قراءة المسطرة غير المدرج
- 33 ← التطابق

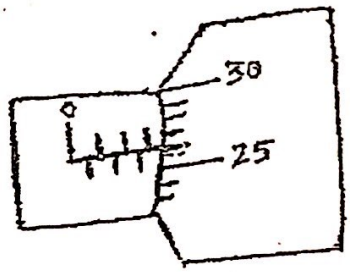
*ملاحظة السؤال حلّ d فقط.

Ex38] 3- MEASUREMENTS AND UNCERTINITIES :

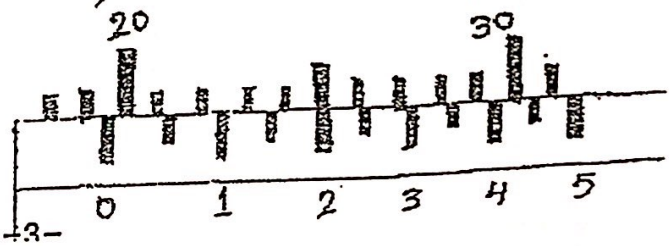
Give the reading for the following instruments

a)

Micrometer



b)



a) مجاز الميكرومتر ⇒ ⇒ $3 + 0 + \frac{26}{100} = 3.26$ mm

b) مجاز الورنية ⇒ $h \Rightarrow \frac{2}{10} + 19 = 19.2$ mm

⇑ نتبع الخطوات المذكورة ⇑ وعرفنا أن نحسن سفياً

Ex 39] The reading of the Vernier Caliper as shown in *fig.2* is:

(a) (4.020 ± 0.0025) cm
(b) (3.902 ± 0.0025) cm
(c) (4.045 ± 0.0025) cm
(d) (3.945 ± 0.0025) cm

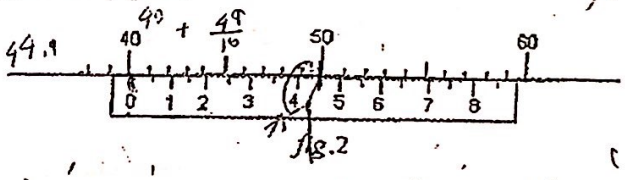


fig.2

Solution: $\underline{h} \Rightarrow \frac{4.5}{10} + 40 = 40.45$ mm ⇒ cm السؤال طلب ⇒ 4.045

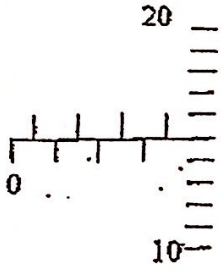
$\Delta h \Rightarrow 0.0025$ cm

$h \pm \Delta h = (4.045 \pm 0.0025)$ cm

فرع ج

Ex40] 7) In the figure, which of the following readings of micrometer (in mm) is correct?

a) 3.15 ± 0.005
b) 3.65 ± 0.050
c) 3.65 ± 0.005 ✓
d) 3.50 ± 0.010

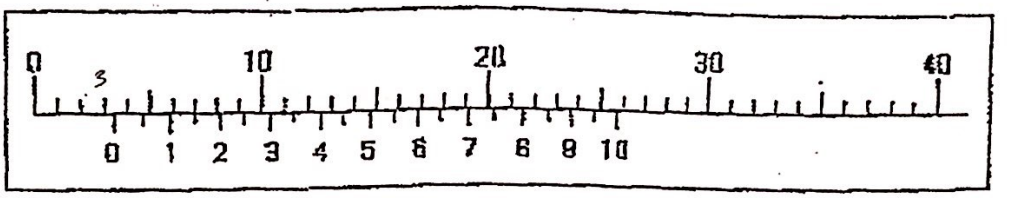


$* d \pm \Delta d \Rightarrow d = 3 + 0.5 + \frac{15}{100} = 3.65$ mm

$\Delta d = 0.005$ mm

$(3.65 \pm 0.005$

Ex 41] 3-The reading of the vernier caliper shown below is: 0.315 ± 0.0025 cm.



* h?? $h = 3 + \frac{1.5}{10} = 3.15\ mm = 3.15 * 10^{-1} = 0.315\ cm$

* $\Delta h \Rightarrow 0.0025\ cm$

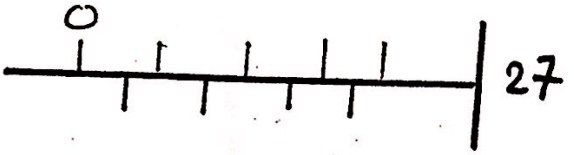
Ex 42] The uncertainty in reading a micrometer in (cm) is:
a) 0.01 b) 0.005 c) 0.0005 ✓ d) None of the above.

الجواب فرع c # من الحفظ

Ex 43] ⊛ The error in the Micrometer reading for a single measurement is: 0.005 mm / 0.0005 cm

⊛ The error in the Vernier caliper is: 0.025 mm / 0.0025 cm

Ex 44] The diameter of asphere is measured by micrometer , Find the Volume of the sphere :



Solution:

$V \pm \Delta V$ المطلوب

$V = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3$

$V = \frac{4}{3}\pi\left(\frac{4.27}{2}\right)^2$

$V = 40.7$

$* \Delta V = V\sqrt{\left(\frac{3\Delta d}{d}\right)^2 + (0)}$

$\Delta V = 40.7\sqrt{\left(\frac{3*0.005}{4.27}\right)^2}$

$\Delta V = 0.142$

$d \pm \Delta d$

↳ 0.00 mm

$d = 4 + 0 + \frac{27}{100}$

$d = 4.27\ mm$

$V \pm \Delta V = 40.7 \pm 0.142$ ※ ☺

Smallest devision

* تم شرح جهاز الورنية والمايكروميتر * بدنا نتحدث عن

للحفظ:

[1] ruler: مسطرة: Analytical : * smallest devision: 1mm (اقل تدريج)

ونسبة الخطأ دائماً 0.05cm حفظ #

[2] Caliper: Analytical : smallest devision: 0.05mm

ونسبة الخطأ: 0.025 mm

تم شرحهم سابقاً

micrometer: Analytical: smallest devision: 0.01mm ← بدون زيادة

[3] Digital balance: Digital : 0.01g

نسبة الخطأ للميزان حفظ

* ملاحظة: نسبة الخطأ = $\frac{\text{اقل تدريج}}{2}$

في جميع الأدوات عدا الميزان نسبة الخطأ = اقل تدريج

2-In an experiment to obtain the density of a cylinder, a student measures its diameter, height and mass that are: 10.0cm, 39.0cm, and 210.01g, respectively. The student uses measuring instrument: ruler and digital balance. If the length of ruler is 20cm then the uncertainty in the density ($\Delta\rho$) is: 0.6049 mg/cm^3.

$$\rho_{cylinder} = \frac{4m}{h\pi d^2} = \frac{4 * 210.01}{39 * 3.14 * (10)^2} = 0.06\ g/cm^3$$

- $\Delta m = 0.01g$ حفظ، لأننا استخدم digital Balance

$$\Delta\rho = \rho\sqrt{\left(\frac{\Delta h}{h}\right)^2 + \left(\frac{2\Delta d}{d}\right)^2 + \left(\frac{\Delta m}{m}\right)^2}$$

- $\Delta h = \Delta d = 0.5mm = 0.05cm$ لأننا استخدم مسطرة (حفظ)

$$= 0.06\sqrt{\left(\frac{0.05}{39}\right)^2 + \left(\frac{0.05*2}{10}\right)^2 + \left(\frac{0.01}{210.01}\right)^2}$$

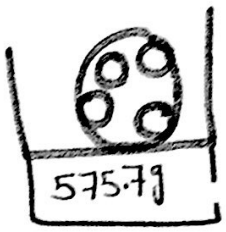
$$= 0.000604\ g/cm^3 \xrightarrow[*10^3]{mg/cm^3} = 0.6049\ mg/cm^3$$

EX* If the ball shown on the digital scale moves with a velocity (10 ± 1 m/s) the uncertainty in momentum in kgm/s is :

$* p = mass * V$

$* \Delta p = m * V \sqrt{\left(\frac{\Delta mass}{mass}\right)^2 + \left(\frac{\Delta V}{V}\right)^2}$

$\Delta m = 0.01\,g$ الخطأ



digital balance

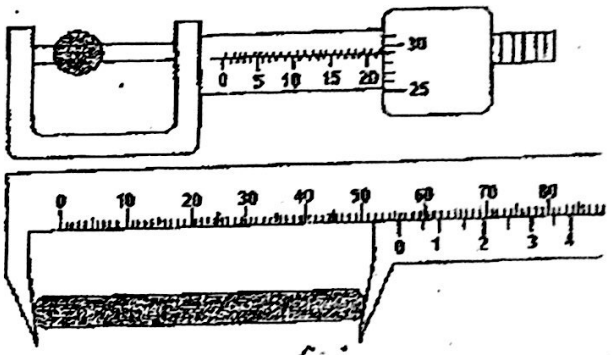
$\Delta p = 10 * 0.5757 \sqrt{\left(\frac{0.01}{575.7}\right)^2 + \left(\frac{1}{10}\right)^2}$

$\Delta p = 0.5257\ kg.m$ ⇐ الجواب

4. The diameter and height of a cylinder are given in *fig.1*. Find the volume (V) of the cylinder (in cm^3) if it's mass is $m \pm \Delta m = (26.33 \pm 0.02)g$

هذا السؤال لم يتم شرح كيفية ايجاد h و d في المحاضرة

a) *1.44*
b) *18.3*
c) *20.6*
d) *1.3*



$h = 55 + \frac{1}{10} = 55.1\ mm = 5.51\ cm$

$d = \frac{29}{100} + 21 + 0.5 = 21.79\ mm = 2.1$

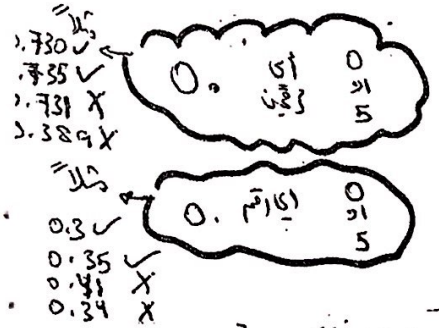
$V_{cylinder} = \pi h \frac{d^2}{4}$

$= 3.14 * \frac{(5.51)(2.179)^2}{4}$

$= 20.58 \approx 20.6\ cm^3$

Which of the following represents a reading of micrometer or Vernier caliper ? وأعطى بالخيارات هذه الارقام

ب: مثال سؤال



حلوات الحل :

نحول القراءات جميعها الى mm

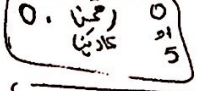
في حالة طلب في السؤال الـ micrometer ← يجب وجود الخانات التالية بالرقم

في حال طلب في السؤال الـ vernier caliper ← يجب وجود الخانات التالية بالرقم

Ex: Which of the following represents a micrometer reading

a) 1×10^{-5} m b) 1.21×10^{-1} mm c) 1.21×10^{-4} cm d) None of the above

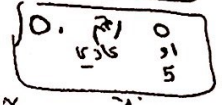
نحول الى mm ثم نرى micrometer



a) $1*10^{-5}m = 1*10^{-2} = 0.01$ mm ✓

b) $1.21*10^{1}$ mm = 12.1 ✗

c) $1.21*10^{-3}$ mm = 0.00121 ✗



واحدة

الإجابة a

2-The sides of a rectangular plate measured by a vernier caliper were found to be 12.04 and 10.12cm. The calculated error in the value of the plate's area in (cm^2) is :

a) 0.039 b) 0.014 c) 0.029 d) None of the above

$$\Delta A = A\sqrt{\left(\frac{\Delta B}{B}\right)^2 + \left(\frac{\Delta C}{C}\right)^2}$$

$A = B * C$ ← الضرب

A: مساحة المستطيل B: الطول

$A = 12.04 * 10.12 = 121.844$

$= 121.84\sqrt{\left(\frac{0.0025}{12.04}\right)^2 + \left(\frac{0.0025}{10.12}\right)^2}$

$\Delta B = \Delta C = 0.0025$ cm لأنه استخدم vernier caliper

$= 0.0389 \approx 0.039\ cm^2$

الإجابة a ✓

... vernier caliper shown below is: ...315 ± ... cm.

نأسف لتعذر كتابة الأسئلة بالسنوات عليها خلال سنة 2015 – 2016
بسبب تعذر قراءة الرسمات وصعوبة ذلك ولكن . . .

الأسئلة على هذه التجربة تقدم

ومع رسمة micrometer & verinier caliper
وطلب $d \pm \Delta d$. وطلب $h \pm \Delta h$

في كل سؤال رسمة لجهاز ثم طلب Volume للكرة او الاسطوانة . / للكرة الاسطوانة

او اي قوانين قد اعطيتكم اياها / C للكرة او الاسطوانة

* في بعض الاسئلة بالسنوات تم وضع micrometer (1) بداخله مربع (1) وطلب مساحة المربع نقول مساحة المربع A
$A \pm \Delta A$
ونجد $\pm \Delta d$
كما عرفنا

* او في بعض الافكار وضع ميزان كما في مثال سابقه.
(2) او طلب محيط المربع = . $4d$ → $C \pm \Delta C$
ونجد $d \pm \Delta d$
كما نعرف

- او سؤال: اي من الاتية تمثل قراءة < مايكرومتر / ورنية
كما في امثلة سابقة

(2) او وضع بداخله دائرة وطلب مساحة الدائرة = $\pi (\frac{d}{2})^2$ ← $A \pm \Delta A$

محيط الدائرة = πd ← $C \pm \Delta C$

ونجد $d \pm \Delta d$

Scanned by CamScanner

Experiment ((3))

Vectors ///

Force table

Exp 3: Vectors , Force Table

* تكون معطى قوى (Forces) ← magnitude : مقدار ، direction : اتجاه ⇐ ومطلوب منا القوّة المحصلة : Resultant force

أو Equilibrium force (حيث أنّ هاتين القوتين متساويتين في المقدار ومتعاكسات اتجاهاً) .

* ملاحظة : حتى نجد resultant force ← مقدار ← تحت الجذر

لـ أما الاتجاه ⇐ حسب الربع

$$\theta_{equilibrium} = \theta_R \pm 180^\circ$$ (يحفظ) ⟹

- الربع الاول : $\theta_R + 180$
- الربع الثاني : $\theta_R + 180$
- الربع الثالث : $\theta_R - 180$
- الربع الرابع : $\theta_R - 180$

معناها : Quart

توضيح لطريقة إيجاد الـ direction : (ملاحظة الزاوية التي بنطلعها هي الزاوية المرجعية وبعدها نوجد الزاوية الاصلية مع محور X+ :

1 الربع الاول :

$\theta' = \theta_R = \tan^{-1}\left|\frac{y}{x}\right| = \tan^{-1}\left(\frac{y}{x}\right)$ ⇐ **هنا الزاوية المرجعية نفسها الأصلية** : *

---

2 الربع الثاني :

$$\theta' = \tan^{-1}\left|\frac{y}{x}\right|$$

هنا هذه الزاوية هي المرجعية θ' ⇐ **لإيجاد الأصلية** θ_R ⇐ $\theta_R = 180^\circ - \theta'$

$\theta = \theta_R$

3 الربع الثالث :

$$\theta' = \tan^{-1}\left|\frac{y}{x}\right|$$

* أما الزاوية الأصلية ⇐ $\theta_R = 180 + \theta'$

---

4 الربع الرابع : $\theta' = \tan^{-1}\left|\frac{y}{x}\right|$ OR $\theta' = \tan^{-1}\left(\frac{y}{x}\right)$ (الزاوية الأصلية)

← اما الزاوية الأصلية (θ_R) ⇐ $\theta_R = 360 - \theta'$ ⟹

---

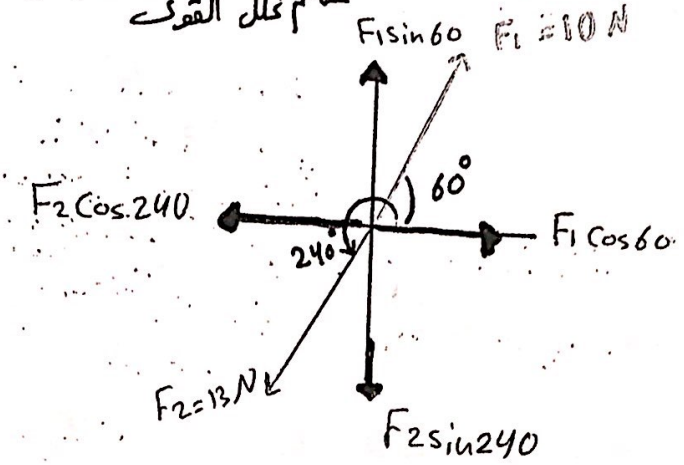
*سيتم طرح الأفكار من خلال المثال السؤال :

نجد θ' ثم θ_R ثم θ_{eq} في حال طلبها #

2) In force table experiment. The magnitude and direction of equilibrant force (القوة المتزنة) for a system consist of two forces; $|F_1| = 10$ N, $\theta_1 = 60^\circ$ and $|F_2| = 13$ N; $\theta_2 = 240^\circ$ will be:

a) 3N, 240 (b) 3N, 60 c) 2N, 60 d) 2N, 240°

Solution: حتى نحل السؤال نمثل القوى على المحاور ⇐ ثم نحلل القوى



ΣF_x (نجد مجموع القوى على x)

$\Rightarrow (F_1 \cos 60) + (F_2 \cos 240)$

$\Rightarrow (10 \cos 60) + (13 \cos 240)$

$\Rightarrow 5 + -6.5$

$F_x \Rightarrow -1.5\ N\ (-\hat{i})$

ملاحظة صدنا الاتجاه حسب القوة الأكبر

6.5 > 5

نفس النظام الإشارة.

ΣF_y (نجد مجموع القوى على y)

$\Rightarrow (F_1 \sin 60) + (F_2 \sin 240)$

$\Rightarrow (10 \sin 60) + (13 \sin 240)$

$\Rightarrow 8.66 + -11.258$

$\Rightarrow \Sigma F_y = -2.59 \approx -2.6\ (-\hat{j})$

لو صدنا الاتجاه لأن 8.66 < 11.258

نفس النظام الإشارة.

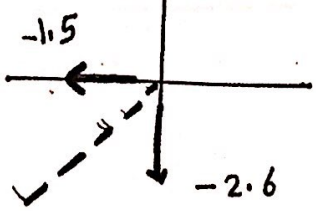
$\vec{F} = -1.5\hat{i} - 2.6\hat{j}$

$mag = \sqrt{(\Sigma F_x)^2 + (\Sigma F_y)^2}$

$= \sqrt{(-1.5)^2 + (-2.6)^2}$

$F_{eq} = 3N$ (مقدار)

الربع الثالث:



$\theta' = \tan^{-1}\left|\frac{y}{x}\right| = \tan^{-1}\left|\frac{-2.6}{1.5}\right| = 60^\circ$

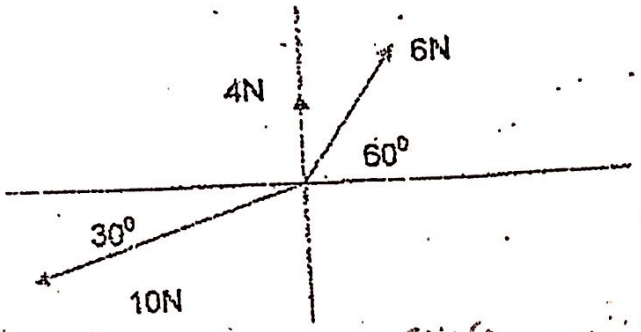
$\theta' = 60^\circ \Rightarrow$ الربع الثالث $\Rightarrow \theta_R = 180 + 60 = 240^\circ$

↳ below $-x$ axis

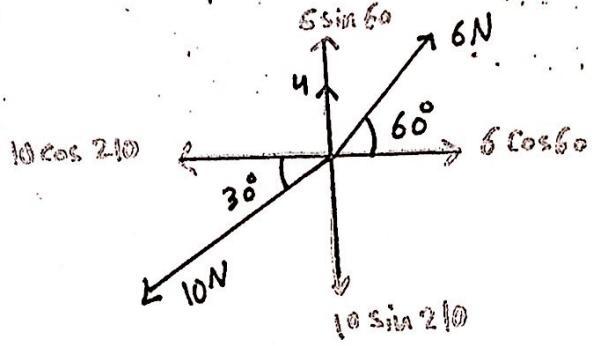
[2] $\theta_{eq} = 240^\circ \Rightarrow$ equilibr اتجاه $\theta_{eq} = \theta_{RN} = 180^\circ + 60 = 240 - 180$

5- In the figure shown, the magnitude of the additional force that should be added to get the system in equilibrium is: **(2 marks)**

a) 7.7N (b) 7.1 N c) 6.6N d) 5.7N e) 2.3N



Solution:



$\Rightarrow \Sigma F_x$

$\Rightarrow 6\cos 60 + 10\cos 210$

$\Rightarrow 3 + -8.7$

$\approx \Rightarrow -5.7\,N\,(-\hat{i})$

$\Sigma F_y \Rightarrow 4 + 6\sin 60 + 10\sin 210$

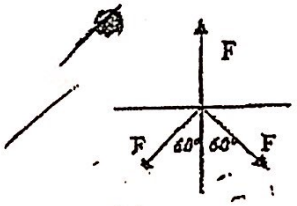
$\Rightarrow 9.196 + -5$

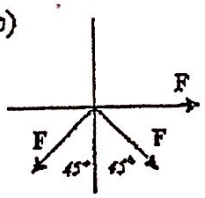
$\Rightarrow 4.196\,N\,(\delta)$

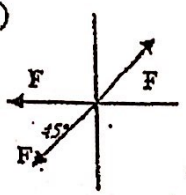
$|\vec{F}|_{eqv} \Rightarrow \sqrt{(-5.7)^2 + (4.196)^2} = 7.077 \approx 7.1\,N$

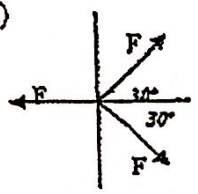
توجيه الكلام منعط لمقدار اتجاه الجواب فرع b ب

10. The system that is under equilibrium is:

(a) 

(b) 

(c) 

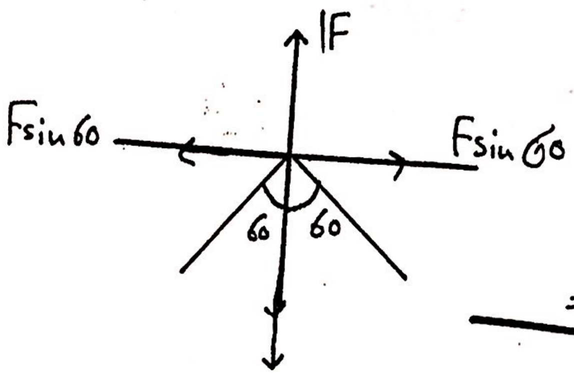
(d) 

* الجواب فرع A

توضيح طريقة الحل في الغلف

* في هذا السؤال طلب منا النظام اللي فيه اتزان " equilibrium " ؟

متى يكون في اتزان لازم
$\Sigma F_x = zero$
$\Sigma F_y = zero$



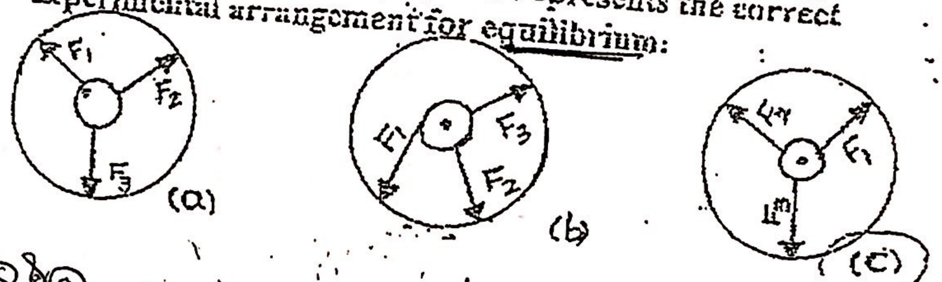
$\Rightarrow \Sigma F_x = 0$

$\Rightarrow F\cos 60 + F\cos 60 \Rightarrow F$ مع F

$\Sigma F_y = 0$

* القوى متساوية مقداراً متعاكسة اتجاهاً !!

... which of the following figures represents the correct experimental arrangement for equilibrium:



الا بمعرفة قيم F_1 ... (a) & (c)

في هذا السؤال قيم القوى واتجاهاتها ناقصة لذلك من الصعب التحديد بين خيار

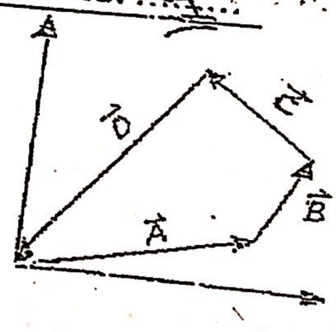
University no..

1- VECTORS:

a- According to the corresponding figure (1)

$\vec{A}+\vec{B}+\vec{C}+\vec{D} =$ D (zero)

$\vec{A}+\vec{B}+\vec{C} = -\vec{D}$

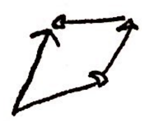


$\vec{A} + \vec{B} + \vec{C} + \vec{D} = zero$

$\vec{A} + \vec{B} + \vec{C} = -\vec{D}$ $\Rightarrow$

السبب محصلة A و B و C = D ولكنه في الرسمة معكوسة بـ $-\vec{D}$.

(من ذيل الأول إلى رأس الأخير) وإذن



3) The major source of inaccuracy in force table experiment is:

a) personal error
b) random error
c) systematic error
d) none of the above

الإجابة هي الفرع (C) لأنه السبب الرئيسي هو الـ friction force وهو بسبب الأداة (systematic)

Ex: In the force Table experiment, suppose that you were told to put 100g at 45° and 150 g at 135°. A third force that is needed to have the system of all three forces in equilibrium has magnitude and direction that are given by: (Acceleration due to gravity $g \approx 10\ m/s^2$)

$F = \_1.8\_\ N$, $\theta = \_281°\_$

Solution: $m_1 = 100g$, $\theta = 45°$

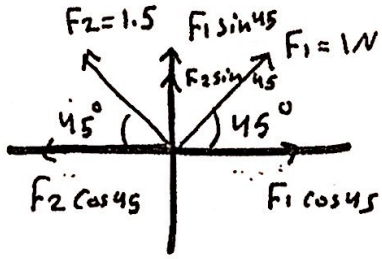
$F_1 = m_1 g$

$F_1 = \frac{100}{1000} * 10 = 1N$

$m_2 = 150g$, $\theta = 135°$

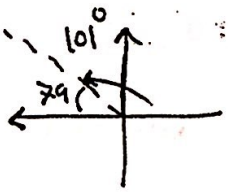
$F_2 = m_2 g$

$= \frac{150}{1000} * 10 = 1.5N$



$\Rightarrow \Sigma F_x = (F_2 \cos 45) - (F \cos 45)$

$\Sigma F_x = 0.35\ (-\hat{i})$



$\Rightarrow \Sigma F_y = (F_1 \sin 45) + (F_2 \sin 45)$

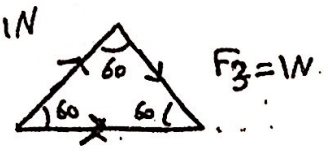
$\Sigma F_y \cong 1.8\ \hat{j}$

$\Rightarrow |\vec{F}| = \sqrt{(0.35)^2 + (1.8)^2} \cong 1.8N$

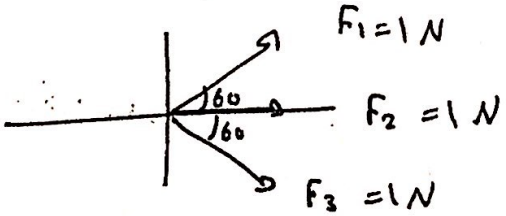
* direction: $\theta' = \tan^{-1}\left|\frac{1.8}{0.35}\right| \Rightarrow 78.9 \approx \underline{79°} \Rightarrow 180 - 79° = \underline{101°}$

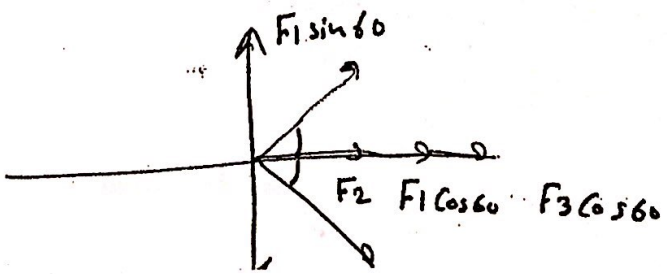
$180 + 101 = 281 \Leftarrow$ equilibrium : لكي تكون

Ex: The resultant force in the figure show:



Solution:





بتحلل القوى

$\Sigma Fx = (F_2) + (F_1 \cos 60) + (F_3 \cos 60) = 2N$

$\Sigma Fy = F_1 \sin 60 - F_3 \sin 60 = 0$

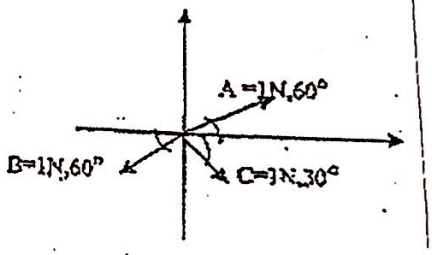
$|\vec{F}| = \sqrt{(\Sigma Fx)^2 + (\Sigma Fy)^2} = \sqrt{(2)^2 + (0)^2} = \sqrt{4} = 2N$ ✓

---

3) In the force table experiment, three forces A, B, C with magnitudes and directions are shown in the figure. The magnitude and direction of equilibrium force:

a) 2, 150° b) 1, 330°

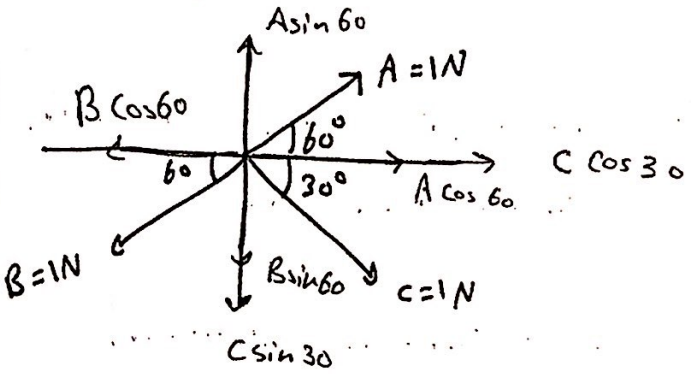
d) 1.7, 330° d) 1, 150°



Solution:

$\Sigma Fx = (1\cos 60 + 1\cos 30) - (1\cos 60)$

$\Sigma Fx = 0.87\,N\,(\hat{i})$

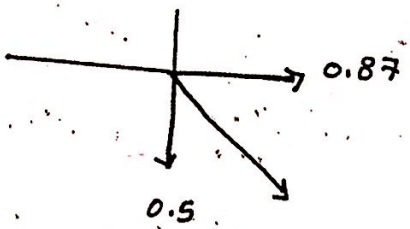


$\Sigma Fy = (\sin 60 + \sin 30) - (\sin 60)$

$\Sigma Fy = 0.5\,N\,(-\hat{j})$

$|\vec{F}| = \sqrt{(0.5)^2 + (0.87)^2} = 1N$

$\theta = \tan^{-1}\left(\frac{0.5}{0.87}\right) = 29.88 \cong 30°$



الربع الرابع

$\theta = 360° - 30° = 330°$

$= 330° - 180° = 150°$

لم زاوية الاتزان.

اذن الجواب 150° او 1

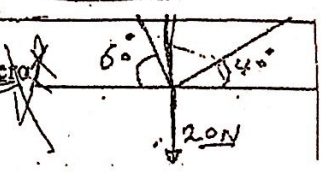
Ex:

(Q6) Table force: A body is said to be in equilibrium if

(a) it has acceleration (b) the resultant force equal to zero

(c) all the applied forces are along the same line

(d) all the applied forces are equal



b) The resultant force equal to zero.

[R1]

Ex

2- Vector

① ⊛ The major error in this experiment is that due to frictional forces [ ] yes

② ⊛ Using force table, one can directly measure the resultant [ ] No

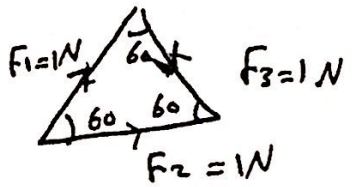
③ ⊛ The method of components to find a resultant is not as accurate as the force table [ ] No

① السبب الرئيسي للخطأ في التجربة هو frictional forces vectors (force table)

② * لأن في التجربة القوة التي نقيسها تكون إيجاد وهي Equ force مباشرة

③ خطأ: لأن التحليل نظرياً ادق من استخدام Force Table عملياً

Ex: The resultant force of the three forces shown in fig shown below:



a 2 N in the −ve x−axise

(b) 2N in the +ve x−axise

c 1N in the − ve x − axis

d 1N in the +ve x − axis

* ج حل السؤال نفس الفكرة * ولكن في الـ direction

---

fig.2

7. A system consists from two forces $\vec{F}_1 = (7\hat{i} + 8\hat{j})N$ and $\vec{F}_2 = (3\hat{i} - 5\hat{j})N$. The equilibriant force (القوة الموازنة) for the two forces is:

a) $(-10\hat{i} - 3\hat{j})N$
b) $(4\hat{i} - 13\hat{j})N$
c) $(10\hat{i} + 3\hat{j})N$
d) $(-4\hat{i} + 13\hat{j})N$

Solution: $|\vec{F}| = \Sigma Fx + \Sigma Fy$

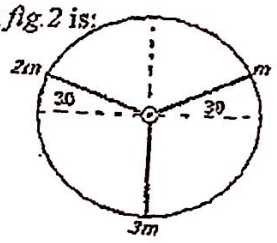
$= (7\hat{i} + 3\hat{i}) + (8\hat{j} + -5\hat{j})$

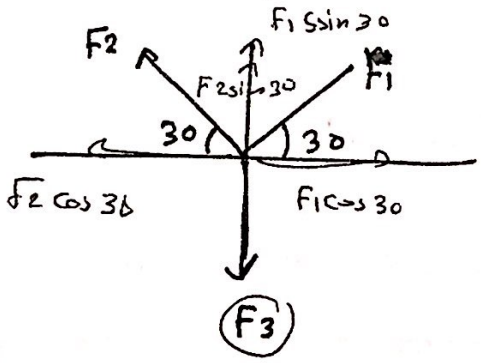
$= (10\hat{i} + 3\hat{j})N$

6. The magnitude of the resultant force of the system shown in *fig.2* is:

a) 3.0mg
b) 2.2mg
c) 1.7mg
d) 6.0mg
e) can not be determine

نوع ≡ الجواب





2m sin 30

(m) → $F_1 = mg$

(2m) → $F_2 = 2mg$

(3m) → $F_3 = 3mg$

$\Sigma Fx = (2mg\cos 30 - mg\cos 30)$

$\Sigma Fx = \cos 30\, gm(2 - 1)$

$\Sigma Fx = 0.87\, gm$

$\Rightarrow \Sigma Fy = (3mg - (mg\sin 30 + 2mg\sin 30))$

$\Sigma Fy = (3mg - 3mg\sin 30)$

$\Sigma Fy = 3mg(1 - \sin 30)$

$\Sigma Fy = 1.5mg$

الإجابة نوع c

$\Rightarrow |\vec{F}| = \sqrt{(0.87\,mg)^2 + (1.5\,mg)^2} = 1.7mg$

i) Two forces are applied to the ring of force table. If $\vec{F}_1$ at an angle $60°$, and $\vec{F}_2$ at $135°$, the equilibrium force will be on the negative y-axis when; **2 Marks**

(a) $m_1 = \frac{1}{2} m_2$

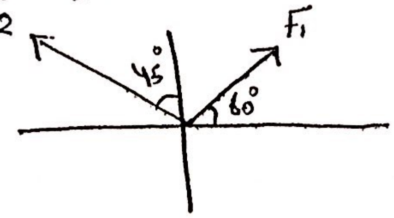
(b) $m_1 = \frac{1}{\sqrt{2}} m_2$

(c) $m_1 = 2m_2$

(d) $m_1 = \sqrt{2} m_2$

أهم هذا السؤال تكرر ٣ مرات

من خلال التحليل



equilibrium : بحالة في حالة الاتزان

$\Sigma F_x = 0 \Longrightarrow$

$F_1 \cos 60 = F_2 \sin 45$

$m_1 g \cos 60 = m_2 g \sin 45$

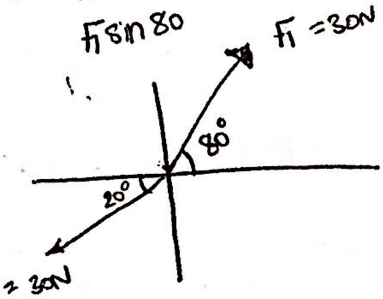
$m_1 = \frac{\sin 45}{\cos 60} m_2$

$$\boxed{m_1 = \sqrt{2}\, m_2}$$

EX1 الفصل الثاني سنة 2016

In the force table experiment $|\vec{F_1}| = |\vec{F_2}| = 30N$ are directed as $80°$ and $200°$ respectively. The direction of the third force $\vec{F_3}$ in (N) which balances the two forces $\vec{F_1}$ and $\vec{F_2}$ is :

الحل: مطلوب إيجاد الـ equilibrium force ∴



$\vec{F_R} = (F_1 \cos 80 - F_2 \cos 20)\hat{i} + (F_1 \sin 80 - F_2 \sin 20)\hat{j}$

$= -22.98\hat{i} + 19.28\hat{j}$

$\theta' = \tan^{-1}\left|\frac{19.28}{-22.98}\right| = 39.99°$

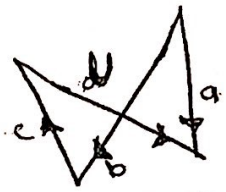
$\theta_R = 180 - \theta' = 180 - 39.9 = 140.01$

$\theta_{eq} = 140.01 + 180 \approx 320°$ #

كانا بالتوفيق

EX2 Find the vector U, in the figure in terms of vectors a, b, c

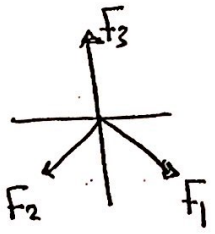
فصل الصيف الدور الثاني سنة 2016



EX4 Find the Resultant force for the three forces in the figure

$F_1 = F_2 = 30N$, $F_3 = 10N$, $\theta_1 = 315$ $\theta_2 = 225$

فصل الصيف الدور الأول سنة 2016



الإجابة: 32.4N بالتحليل: بإيجاد المحصلة الأولى ثم المحصلة الثانية

EX5 In the previous questions what's the direction of the equilibrium force?

الإجابة: 90° بإيجاد قياس الزاوية الثانية

EX6 one student found the resultant direction of two vectors in second quarter the direction of equilibrium force vecto

فصل الصيف الدور الأول سنة 2016

equal ⟹

الخيارات

(a) $\theta_{eq} = \theta_R$ (b) $\theta_{eq} = 180 - \theta_R$

الإجابة (c) $\theta_{eq} = \theta_R + 180$ (d) $\theta_{eq} = -\theta_R$

لأنه في الربع الثاني

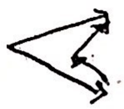
EX6 In an experiment, one student found the resultant direction of two vectors in first quarter, the direction of equilibrium force vector equal:

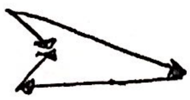
فصل الصيف الدور الثاني سنة 2015

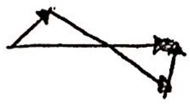
الإجابة: $\theta_{eq} = \theta_R + 180$ لأنه في الربع الأول

EX7 Which of the following diagrams represents $\vec{U}-\vec{a}=-\vec{b}-\vec{c}$

فاينل الصيفي الثاني لسنة 2015

ⓐ 

ⓑ 

ⓒ 

ⓓ 

X8 generally speaking, If the balance force makes an angle θ relative to x-axis, then the resultant force will be:

الصيفي الثاني ميد 016

ⓐ $\theta \mp 180$

ⓑ $\theta + 360$

ⓒ $\theta + 180$

ⓓ both ⓐ and ⓒ are correct ← الجواب

لوحتى بيحكالك امتى تكون $\theta_R \pm 180$ لا

الربع الأول + الثاني ⇐ $\theta_R + 180$

الربع الثالث + الرابع ⇐ $\theta_R - 180$

EX9 two forces, one of magnitude 2N and the other of magnitude 3N, an applied to the ring of a force table. the directions of both forces are unkown, which best direction the Limitions in R the resultant?

ميد الثاني 016

حدود قيمة R

الخيارات ←

ⓐ $R \leq 5N$

ⓑ $5N \leq R \leq 11N$

ⓒ $R \geq 3N$

ⓓ $1N \leq R \leq 5N$ ← الاجابة

ⓔ $R \leq 2N$

نطرح القوتين (1N) — نجمع القوتين (5N)

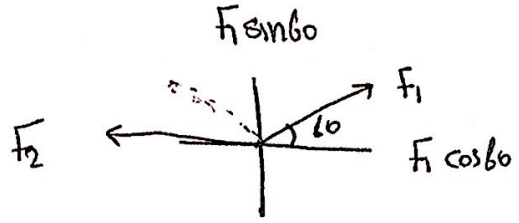
13

EX10 Two forces are applied to the ring of force table. If $\vec{F_1}$ at an angle 60° and $\vec{F_2}$ at 180°, the equilibrium force will be in the negative y-axis when

(a) $m_1 = 2m_2$ ✓ الجواب

(b) $m_1 = \sqrt{2}\, m_2$ (c) $m_1 = \frac{1}{2} m_2$

(d) $m_1 = \frac{1}{\sqrt{2}} m_2$



الرسمة الأولى

equilibrium $\Rightarrow$ $F_1 \cos 60 = F_2$

$m_1 g \cos 60 = m_2 g$

$m_1 * \frac{1}{2} = m_2$

$\#$ $m_1 = 2m_2$

EX11 $F_1 = F_2 = 30N$ are directed at 90° and 210° respectively. the direction of the third force F_3 which balance the two forces F_1 & F_2 is :

330°

من خلال التحليل الإجابة :

EX12 A system of forces consists of $\vec{F_1}$ (7N with 75°) and F_2 (5N with 255°)

then the magnitude of the third force F_3 which balance F_1 / F_2 is :

2N with 255° ✓ الجواب

بالتحليل

Experiment (4)

Kinematics of Rectiliner Motion

Exp 4: Kinematics of Rectilinear Motion:

الشكل ١٣

* ١ لما تطلب في السؤال (Total distance) : المسافة هي نصف المساحة تحت المنحنى حسب الرسمة في المستوى الميكانيكي بنجزء

ملاحظة : مساحة المثلث : $\frac{1}{2}$ * طول القاعدة * الارتفاع

: مساحة المربع = (طول الضلع)^2

مساحة المستطيل = (الطول * العرض)

* وحدة المسافة إما (m أو cm) حسب ال (السرعة) Velocity في السؤال أو حسب الوحدة المطلوبة في السؤال ..

** ٢ : لما تطلب :

instantaneous velocity

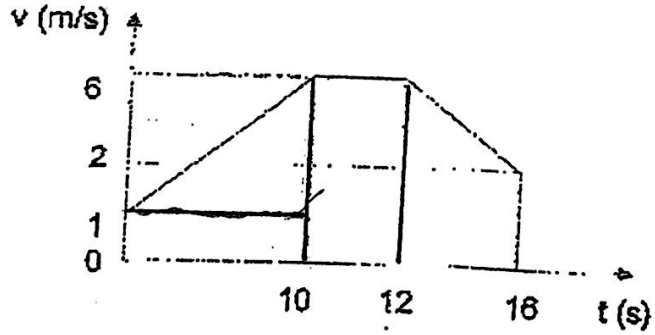
* السرعة اللحظية ← * نشوف الزمن المطلوب عنده السرعة ونوصل خط عمودي من هذا الزمن حتى يتم التقاطع مع الرسمة .

** ٣ : اذا طلب : Average acceleration

$$\bar{a} = \frac{\Delta V}{\Delta t} = \frac{\text{التغير في السرعة}}{\text{التغير في الزمن}} = \frac{V_f - V_i}{t_f - t_i} \quad (m/s$$

Ex :

6- In the experiment on the Kinematics of Rectilinear Motion, the following velocity versus time graph was obtained as below. Use this figure to answer the following questions:



a) The total distance traveled in the first 12 seconds is: (2 marks)
a) 35m b) 25m c) 47m d) 35m^2 e) 47m^2

b) The average acceleration in the time interval t =0 to t = 12 second is (2 marks)
a) 1.5ms^{-2} b) 0.75 ms^{-2} c) 0.51 ms^{-2} d) 0.06 ms^{-2}
e) 0.42 ms^{-2}

c) the instantaneous Velocity at time = 10 sec

Solution; a Total distance?? in the first 12 sec

كما ذكرنا المسافة هي المساحة تحت المنحنى وحسب السؤال المسافة أول 12 ثانية

بالتالي بنجزئ الرسمة من (0 ــ 10) ومن (10 ــ 12)

0 ــ 10

نلاحظ أننا سنجزئ الشكل مرة أخرى إلى مثلث ومستطيل

مثلث

مساحة = $\frac{1}{2}$ * طول القاعدة * الارتفاع

$= \frac{1}{2} * 10 * (6-1)$

$= \frac{1}{2} * 10 * 5$

$= 25\ m$

مستطيل

مساحة = الطول × العرض

$= 10 * 1$

$= 10\ m$

(10 ــ 12)

مساحة المستطيل = الطول × العرض

$= 6 * (12 - 10)$

$= 6 * 2$

$= 12\ m$

* نجمع المساحات التي تعبر عن المسافة:

$25 + 10 + 12 = 47\ m$

∴ Total distance = 47 m

---

b $\bar{a} = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t_f - t_i} = \frac{6-1}{12-0} = \frac{5}{12} \approx 0.42\ m/s^2$

ملاحظة: مثلاً عند الزمن 12 بنمد خط حتى نقطع الرسمة وبالتالي نقطة التقاطع هي السرعة للجسم وهي 6 على سبيل المثال !!

c) 6 m/s

الشكل الثاني: مستطيلات

* الفكرة الثانية: شبيهة بالفكرة الأولى بكون معطي على المستوى الديكارتي رسمة أعمدة بين (V-t) السرعة والزمن

a Total distance: نفس الطريقة الأولى (مساحة المستطيلات)

c instantaneous Velocity أو Avg velocity عند لحظة معينة

إذا كانت السرعة المطلوبة عند زمن بين المستطيلات نبوصل خط ونأخذ السرعة عند التقاطع !!

أما إذا كانت السرعة المطلوبة لزمن موجود عند الأطراف: في حال قال instant: نوصل بين منتصف المستطيلات ...

2 تابع شرح طلب السرعة عند لحظة معينة ((التسهيل))

I) لو طلب Avg velocity عند لحظة معينة ⟸ نرى هذه الثانية (مكان وجودها بالنسبة المستطيل)

بالنص: ←

على الحافة: نأخذ الحافة اليمنى قراءتها.

II) لو طلب Inst velocity عند لحظة معينة ⟵ نرى هذه الثانية (مكان وجودها)

بالنص: ←

على الحافة: نصل بين انصاف المستطيلات نوصلها ثم ←

طلب: Avg a : حسب القانون.
Avg a $_{t=a \to t=b}$ =
$\frac{(\text{Avg } v \text{ at } b) - (\text{Avg } v \ldots)}{b-a}$

مثلا

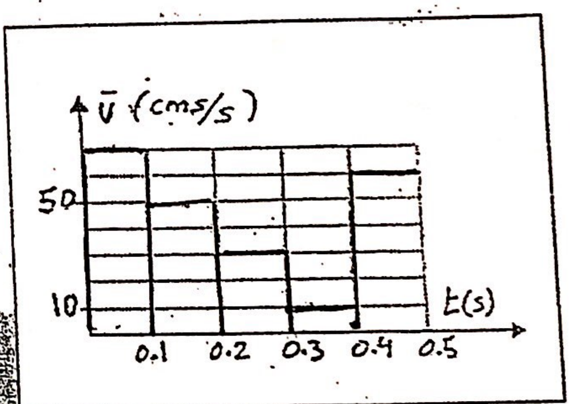
Ex Find Avg velocity at t = 3 sec

Find inst velocity at t = 3 sec

مهم هنا طريقة الحل تختلف حسب موقع الثانية بالنسبة للمستطيلات ... في الحل سنظهر ذلك

٢: ⊛ **Kinematics of Rectilinear Motion:**

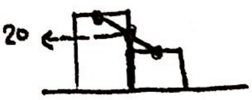
5- In the experiment of one dimensional rectilinear motion, the figure shows a histogram plot of $\bar{V}$ versus t. then the instantaneous velocity at t = 0.3 s is:



a) 10 cms/s **b) 30 cms/s**

c) 20 cms/s **d) 35 cms/s**

Solution: * هون طلب السرعة اللحظية عند الزمن 0.3 وجات عند الاطراف. وطلب instant



⟸ بنعمل سهم من نصف المستطيل الاول إلى نصف المستطيل الثاني

⟸ وبعدين بنمد خطا من 0.3 حتى يتقاطع مع السهم

⟸ وبعدين ⟵ نشوف السرعة المقابلة لهذا التقاطع وهي 20

In the "Kinematics of Rectilinear Motion" experiment; depending on fig.3; answer questions 6 and 7.

6. The distance (in *m*) traveled in the first *0.3 seconds*:

(a) 4.8
(b) 6.0
(c) 1.2
(d) 1.6

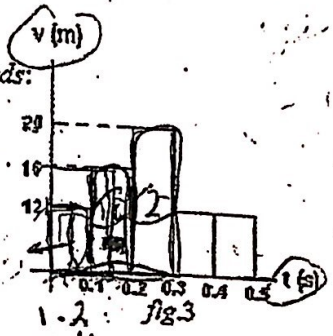


fig.3

* طلب في السؤال ⇐ distance يعني نفسها المسافة.

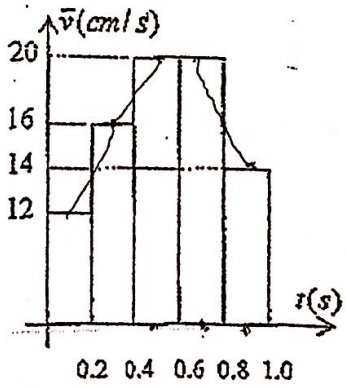
(0 → 0.3) sec

0 → 0.1	0.1 → 0.2	0.2 → 0.3
مساحة المستطيل = الطول × العرض	مساحة المستطيل = الطول × العرض	= الطول × العرض
0.1 * 12	0.1 * 16	0.1 * 20
= 1.2	= 1.6	= 2

distance = 1.2 + 1.6 + 2 = 4.8m

a ج

In the Kinematics of Rectilinear Motion experiment; the following velocity versus time graph was obtained as below. *Use this figure to answer questions from 6 to 9.* 4 Ma



6) The total distance travelled in the first 0.3seconds is:

(a) 7.6 cm
(b) 7.6 cm^2
(c) 4cm
(d) 4 cm^2

7) The instantaneous velocity at *t=0.9sec* is:

(a) 20 cm/s
(b) 14 cm/s
(c) 16 cm/s
(d) can not be determined

8) The average acceleration of the object on the time interval (*0.5sec - 0.7sec*) is:

(a) 0 cm/s^2
(b) -30 cm/s^2
(c) 20 cm/s^2
(d) 30 cm/s^2

9) The average velocity at *t=0.8sec* is:

(a) 14 cm/s
(b) 16 cm/s
(c) 12 cm/s
(d) can not be determined

solution: 6) Total distance ⇒ 0 → 0.2

مساحة المستطيل = الطول * العرض

$0.2 * 12 =$

$= 2.4$

0.2 → 0.3

الطول * العرض

$= 0.1 * 16$

$= 1.6$

$2.4 + 1.6 = 4\ cm$

فرع c

---

7) 0.9 ⇒ هذا الزمن جاء بالمنتصف بالتالي :

بنعمل هيك وبنطالع السرعة .

الجواب : 14 cm/s فرع (b)

---

8) $\vec{a}_{(0.5 \to 0.7)} = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t_f - t_i} = \frac{20 - 20}{0.7 - 0.5} = \frac{0}{0.2} = Zero$

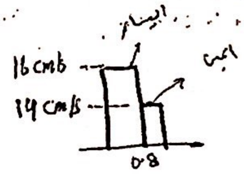
---

9) 14 cm/s ⇒ average Velocity

كما نفهم على الحواف نرى : Inst v : نعمل بين انصاف المستطيلات

Avg v : اليمين

هنا Avg لذلك اليمين : 14 cm/s



---

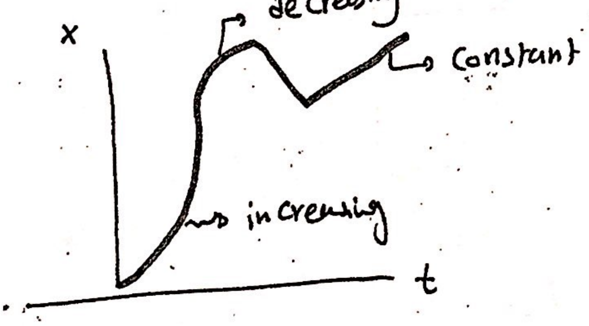
* الفكرة الثالثة :

1 ملاحظة :

decreasing : متناقصة

increasing : متزايدة

constan : ثابت



تبادل معطيات على المستوى الديكارتي بين

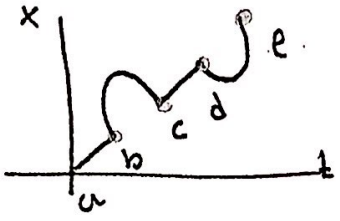
X (distance) و t (time) مدخلاتها

(Velocity) نستنتج سرعة الجسم

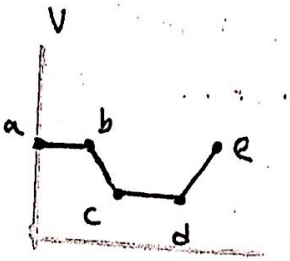
Particle

constant ━ ; increase ∪ ; (decrease لاحقا) ∩ ⇐

Ex: plot graph represent speed versus time and show all points on graph

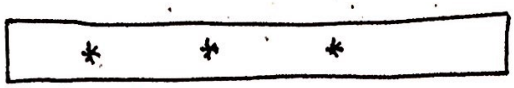


Solution:



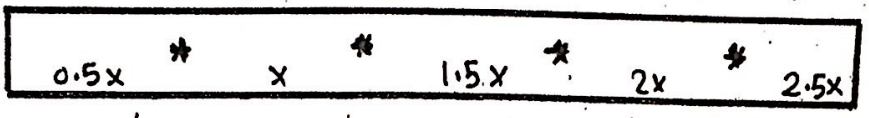
الشكل الثالث

* الفكرة الرابعة: بدون معطيات شريط ورقي



وهنا بين كل نقطة وأخرى هالزمن ويطلب مجموعة من المطالب سيتم توضيح هذه الفكرة من خلال مثال وحله ثم طرح أسئلة السنوات:

Ex:



Consider the time between two Conseclive points is 0.1 sec and $\Delta x = 1$ cm

* دائماً لما تشوف هذا النوع من الأسئلة ↑ بترسم ٣ جداول:-

t (sec)	X (cm)
0 (بنبدأ من الصفر)	0
0.1	0.5
0.2	(0.5+1)
0.3	(0.5+1+1.5)
0.4	(0.5+1+1.5+2)
0.5	(0.5+1+1.5+2+2.5)

بنزيد 0.1 كرة

* دائماً بنبدأ من zero وبنزيد حسب الزمن اللي بعده

time interval	$V\left(\frac{\Delta x}{\Delta t}\right)$
0 → 0.1	5
0.1 → 0.2	10
0.2 → 0.3	15
0.3 → 0.4	20
0.4 → 0.5	25

بنطبقه على القانون

t mid	V mid	$a = \frac{\Delta V}{\Delta t}$
0.05	5	50
0.15	10	50
0.25	15	50
0.35	20	50
0.45	25	50

اما t-mid مثلاً: $\frac{0+0.1}{2}$ وهكذا وأسهل إنه من 0.05 ثم كل مرة أزيد 0.1

ننقل V في الجدول الثاني كما هي

أيضاً من القانون $a = \frac{\Delta V}{\Delta t}$

ملاحظة: ليس من الضروري أن يكون a ثابتة = 50 صفة

اما هنا المسافة X أيضاً نبدأ من zero ومن ثم نضع المسافة الأولى ومن كل مرة نزيد المسافة اللي قبلها

* الأسئلة على الجزء الفكرة :

* Find the displacement of the motion

* حل البدول الأول :

دائماً نأخذ المسافة النهائية وهي 8

: $(0.5+1+1.5+2+2.5)=7.5\,cm$

---

* Find the smallest or largest average velocity

* حل البدول الثاني :

smallest → 5 ، largest → 25

* Find time interval have smallest or largest average velocity

smallest → $(0 \to 0.1)$ ، largest → $(0.4-0.5)$

---

* Find the instantan velocity at $t=0.05$?? 5

* Find the acceleration of the motion ?? $50\ m/s^2$

* حل البدول الثالث :

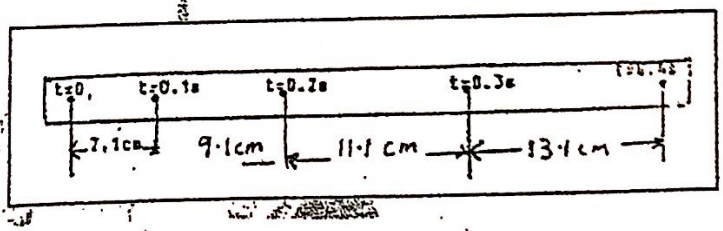
* اذا كان التسارع متغير بعدد الزمن أو يكتب largest or smallest

---

X] . **The ticker tape shown below was recorded for a certain uniformly accelerated motion. the average acceleration in (cm/s^2) is**

b) 200 a) 293

d) 132 c) 260



Solution :

t	x
0	0
0.1	7.1
0.2	16.2
0.3	27.3
0.4	40.4

t_{int}	V
$0 \to 0.1$	71
$0.1 \to 0.2$	91
$0.2 \to 0.3$	111
$0.3 \to 0.4$	131

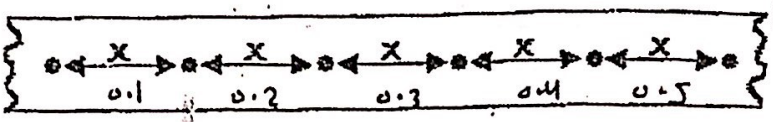
↓

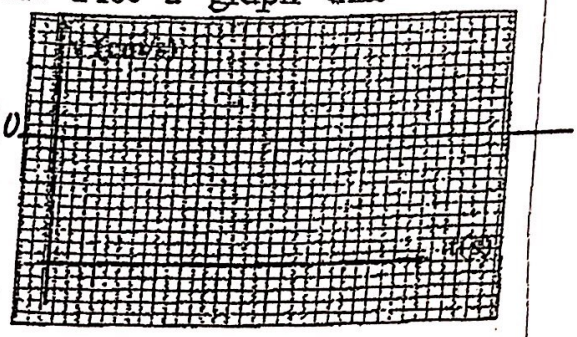
$\frac{\Delta x}{\Delta t}$ على

t_{mid}	V_{mid}	a
0.05	71	200
0.15	91	200
0.25	111	200
0.35	131	200

لاحظ a ثابت دائماً في هذا المثال

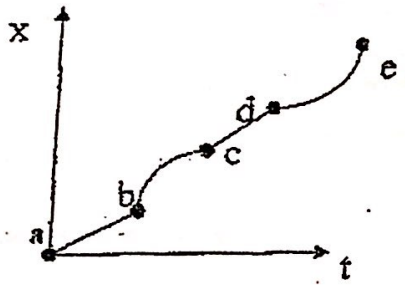
9-For the ticker tape shown below, if the time between two consecutive points is 0.1sec and x =1cm. Plot a graph that represents the velocity versus time?

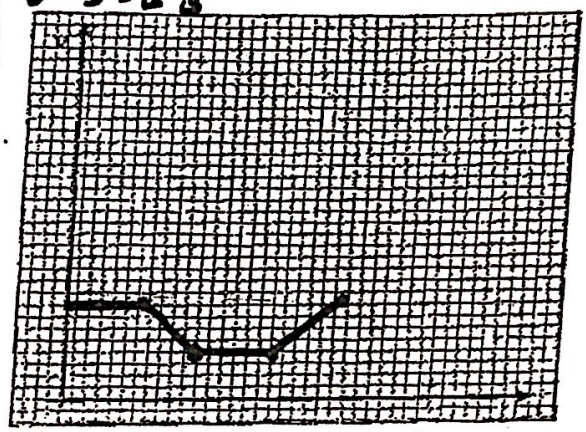




Ex 10-In the experiment of rectilear motion, use the graph below to plot graph represent speed versus time and show all points on graph.

الحل | كما ذكرنا في الفصل





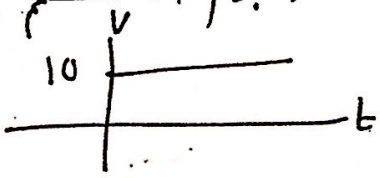
Ex 9:

t	X
0	0
0.1	1
0.2	2
0.3	3
0.4	4
0.5	5

t	V
0 → 0.1	10
0.1 → 0.2	10
0.2 → 0.3	10
0.3 → 0.4	10
0.4 → 0.5	10

مشتقها من x → v

* نرسم خط مستقيم



6) The position in (m) of a particle as a function of time in (sec) is given by: $x=2t^3+5t-6$. The average acceleration in (m/sec^2) between 3 and 5 sec. is :

a) 24 b) 48 c) 35 d)None of the above

7- Using the previous question, the acceleration in (m/sec^2) at t=1sec is:

a)24 b)42 c)11 d)None of the above

$x = 2t^3 + 5t - 6$

$v = 6t^2 + 5$

$a = 12t$

⑨ Avg a $= \frac{v(5) - v(3)}{5-3} = \frac{155 - 59}{2}$ $t=3 \to t=5$

$= 48\ m/sec^2$ ⑨ ع

⑥ $a(1) = 12 * 1 = 12\ m/sec^2$

3- Kinematics of Rectilinear Motion:

Note: Time interval between two successive points equal 0.1 s

- In the first two intervals, the speed is almost equal [ ]
- The acceleration at 0.2 s is negative [ ]
- The largest acceleration occurs at 0.4 s [ ]
- The speed is slowest at 0.25 s. [ ]

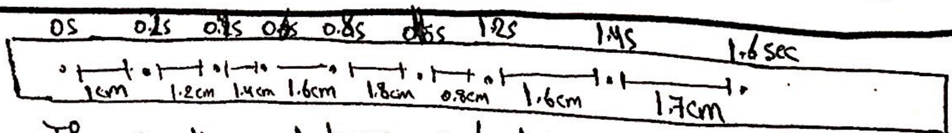
(السؤال غير كامل يجب وجود رسمة، وتيقاً كانوا موزعوا ورق عليه الرسمات)

EX1 In Kinamatic experiment, the tape represents the distance only (X)

the tape represents distance & time :الإجابة الصحيحة

EX2 In Kinamatic experiment, the distance between taps represents velocity and acceleration (✓)

EX3
امتحان الفصل الثاني لسنة 2016 (ميد)



If the time between each two concessive points is 0.2sec:

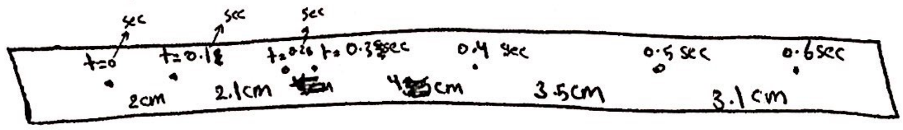
① Find the distance traveled in the time interval (0.6s & 1.0sec).
ⓐ 3.0 cm ⓑ 2.6cm ⓒ 3.4 cm (circled) ⓓ 4.2cm

② Find the instontanius velocity at t=0.7sec:
ⓐ 9cm/s ⓑ 7 cm/s ⓒ 8 cm/s (circled) ⓓ 6 cm/s

③ Find the Avg Accleration of the object on the time interval (1.1 to 1.3)sec
ⓐ -0.25 cm/s² ⓑ 26 cm/s² (circled) ⓒ 5cm/s² ⓓ 2.5cm/s²

فاينل الصيفي الاول + الثاني لسنة 2016 + فاينل الصيفي الثاني لسنة 2015

Ex 21 the following tape was obtained, answer the Questions using this tape



① If the Avg acceleration in the interval (0.15 - 0.25) s is $-1.60\ m/s^2$ then the distance (in cm) moving the interval (0.2 - 0.3) s is:

الخيارات (a) 0.5 (circled) (b) 0.6 (c) 0.7 (d) 0.8 (e) 0.9

② The velocity was heghest at time:

الخيارات (a) 0.15 sec (b) 0.55 sec (c) 0.4 sec (d) 0.35 sec (e) 0.25 sec (circled)

③ The smallest magnitude of acceleration occurs at time:

الخيارات (a) 0.1 sec (b) 0.2 sec (c) 0.5 sec (d) 0.4 sec (e) 0.3 sec (circled)

لحل الأسئلة نقوم بعمل عدة جداول

① $a = \frac{\Delta V}{\Delta t}$

نحولها من $m/s^2 \to cm/s^2$ لانه يطلب الاجابة بال cm

$-1.60 = \frac{V(0.25) - V(0.15)}{0.25 - 0.15}$

$-160 = \frac{V(0.25) - 21}{0.1}$

$\boxed{V(0.25) = 5\ cm/s}$

الآن

$V(0.25) = \frac{\Delta X}{\Delta t}$

$V(0.25) = \frac{\Delta X}{0.3 - 0.2}$

$5 = \frac{\Delta X}{0.1}$

الجواب هو a ⟵ $\boxed{\Delta X = 0.5\ cm}$

t(sec)	X(cm)
0	0
0.1	2
0.2	4.1
0.3	4.6
0.4	8.6
0.5	12.1
0.6	15.2

ملاحظة: تم جمع ... الاعداد ... الاول

time interval	$\Delta V = \frac{\Delta X}{\Delta t}$
0 → 0.1	20
0.1 → 0.2	21
0.2 → 0.3	50
0.3 → 0.4	40
0.4 → 0.5	35
0.5 → 0.6	31

تم تعبئتهم بعد حل الفرع الأول من السؤال

t mid (s)	v mid (cm/s)	Avg a
0.05	20	10
0.15	21	290
0.25	50	-100
0.35	40	-500
0.45	35	-40
0.55	31	

② نقوم بتكملة تعبئة الجداول؛ ملاحظة: قبل السؤال الأول فقد استطعنا أن نعبئ فقط اول ٣ صفوف في الجدول الاول
و اول صفين في الجدول الثاني والثالث
والآن سوف اكمل الجداول كاملة بعد ان عرفنا جميع ابعاد
و يظهر في الجدول الثالث ان اعلى سرعة كانت عند الثانية 25 sec

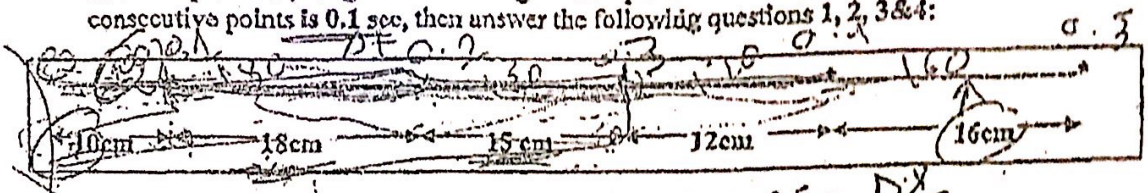
③ (e) هي 0.35 من الجدول الثالث اقل تسارع كان عند الثانية

1/2

EX5

❖ **Kinematics of rectilinear motion experiment:**

In this experiment, we get the following ticker tape. If the time between two consecutive points is 0.1 sec, then answer the following questions 1, 2, 3&4:



1) The smallest average velocity (in cm/sec) is:

a) 100 b) 120
c) 180 d) 80

2) The smallest average acceleration (in cm/s²):

a) 400 b) 800
c) -800 d) -300

3) The velocity (in cm/sec) at t=0.45 sec is:

a) 100 b) 120
c) 150 d) 160

4) The area under the curve of (V and t) from (0.1-0.3) sec will be:

a) 18 cm² b) 27 cm²
b) 28 cm d) 33 cm

t (s)	X (cm)
0	0
0.1	10
0.2	28
0.3	43
0.4	55
0.5	71

time interval	Avg V (cm/sec)
0 → 0.1	100
0.1 → 0.2	180
0.2 → 0.3	150
0.3 → 0.4	120
0.4 → 0.5	160

tmid	Vmid	Avg a
0.05	100	800
0.15	180	-300
0.25	150	-300
0.35	120	400
0.45	160	

1 ✓ 2 ✓ 3 ✓ 4 ✓

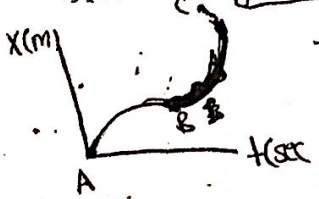
fig.1

5. In kinematics of rectilinear motion experiment, which of the following statements is correct?

a) The dots on the tapes represent position and time.
b) The instantaneous velocity can be found directly from the tape.
c) The maximum and minimum average velocity can be found directly from the tape.
d) Both (a) and (c) are correct.

Q14) Kinematics of rectilinear motion: The dots on the tape represent
a) position b) position and time c) acceleration d) time

EX 2014



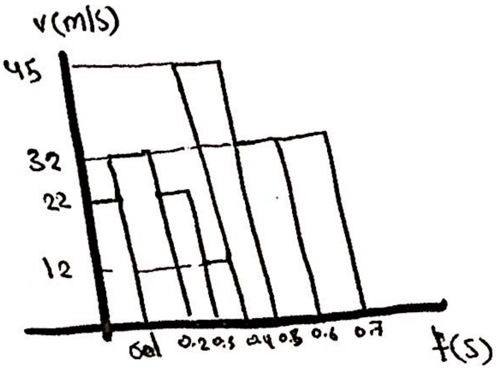
In the figure ⇒ decreasing from A to B, Increasing from B to C

EX₆ ① The distance (in m) traveled by the object in the time interval (0.45 – 0.55) sec is:

ميد الفصل الأول لسنة 2016

المساحة تحت المنحنى ; شبه منحرف + شبه منحرف

$\frac{1}{2}(0.1 * 32) + \frac{1}{2}(0.1 * 45) = 3.85\ m$ #



② the instantaneous velocity in (m/s) at t = 0.35 sec is:

12 m/s   الإجابة : ← كالنقطة في المنتصف

③ the Avg acceleration in (m/s²) of the object on the time interval (0.35 – 0.45) sec is:

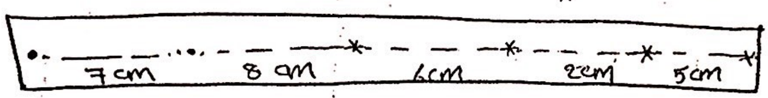
الحل :

$$\text{Avg } a = \frac{\Delta V}{\Delta t}$$

$$= \frac{V(0.45) - V(0.35)}{0.45 - 0.35} = \frac{45 - 12}{0.1} = 330\ m/s^2$$

#

EX If the time between two consecutive (متتالية) points is 0.1 sec answer the Questions.



① The velocity in (cm/s) at 0.4 second is:

الخيارات ⓐ 80 ⓑ 60 ⓒ 70 ⓓ 50 ⓔ 20

خطوات الحل

بالحل : عما

تحدثنا سابقاً

② The smallest Avg acceleration in (cm/s²) is:

الخيارات ⓐ 300 ⓑ 400 ⓒ 200 ⓔ 100

③ The Largest Avg velocity in (cm/s) is:

الخيارات ⓐ 20 ⓑ 50 ⓒ 60 ⓓ 20

EX From the graph below, answer the Questions:

ميد الفصل الأول لسنة 2015

① the distance moved (in m) by the object in the interval (1,3) is:

50 m = 1*34 + 16*1 : مساحة المستطيل

② the Avg acceleration in (m/s²) in the interval (1,3) is:

$$\text{Avg } a = \frac{V(3) - V(1)}{3 - 1} = \frac{34 - 16}{2} = 9$$

#

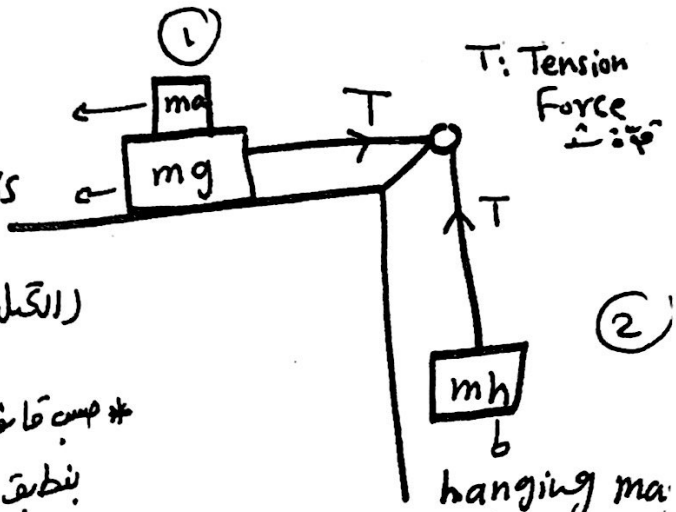
Experiment 5

Force And Motion

Ex 5: Force and motion:

ma: added mass

mg: glaider mass



* $M_{Cart} = m_a + m_g$. (التكلتين معاً) ملاحظة

$F = ma$ * حسب قانون نيوتن الثاني بنطبق على الجسمين .

① $T - 0 = m_{cart}\, a$

② $m_h g - T = m_h a$ + نجمع المعادلتين

$\Rightarrow m_h g = m_{cart}\, a + m_h a$

$\Rightarrow m_h g = (m_{cart} + m_h)\, a$ ← معادلة حركة

m_h: hanging mass

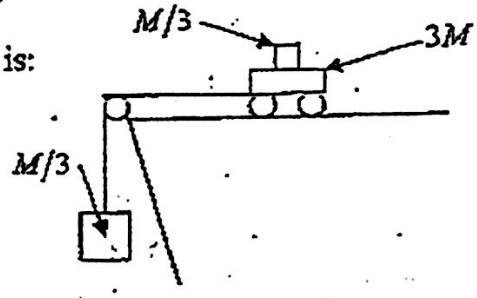
g: gravity

a: acceleration

Note: في الأسئلة عذا طلب Driving Force فهو يقصد $= m_h g$

$$m_h g = (m_h + m_a + m_g)\, a$$ ✓ هذا القانون هو الرئيسي في التجربة

Ex: If you have the following setup for force and motion experiment, *answer questions 12 and 13*. (*NOTE*: the friction force is neglected.)



12) The force acting on the system (driving force) is:

(a) $Mg/3$
(b) $11\,Mg/3$
(c) $Mg/4$
(d) $9Mg/2$

13) The acceleration of the group is:

(a) $g/18$
(b) $g/4$
(c) $g/11$
(d) $3g/4$

Solution: 12) driving force = $m_h g$ $\frac{M}{3} g$

$= \frac{M}{3} \cdot g$

(a) ✓

13) $m_h g = (m_a + m_h + m_g)\, a$

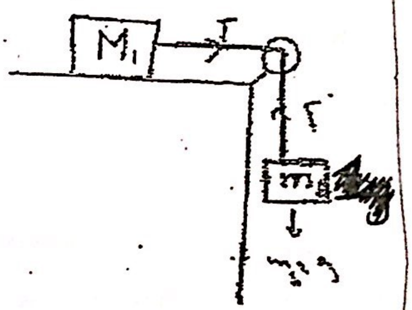
$\frac{M}{3} g = (3M + \frac{M}{3} + \frac{M}{3})\, a$

$\frac{M}{3} g = \frac{11}{3} M a$

$a = \frac{g}{11}\ m/s^2$

4- FORCE AND MOTION :

a- According to the corresponding figure (2)
If M=2m , then the tension in the string (T)
Consider $g = 9.8\ m/s^2$.



(a) 6.5 m
(b) 3.5 m
(c) 3.3 m
(d) 9.8 m

b- In force and motion experiment we changed the inclination of the track to eliminate what force Frictional (الاحتكاك)

الطريقة الأولى :

a-) $T = Ma$ --- ①

$mg - T = ma$ --- ②

$\Rightarrow mg = Ma + ma$

$\Rightarrow mg = 2ma + ma$

$\Rightarrow mg = 3ma$

$\Rightarrow a = \frac{g}{3}\ m/s^2$ نعوض في المعادلة

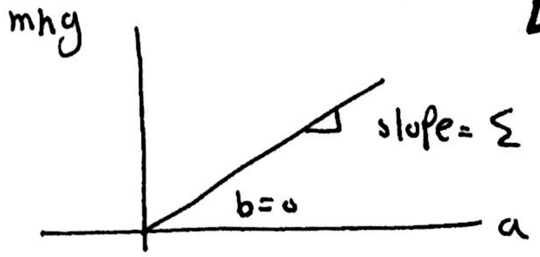
$\Rightarrow T = Ma$

$\Rightarrow T = 2m\, a$

$= 2 * m * \frac{9.8}{3} = 6.53 m \approx (6.5\ m)\ N$, الجواب قوة

$m_h g = (m_a + m_h + m_g)\, a$

1

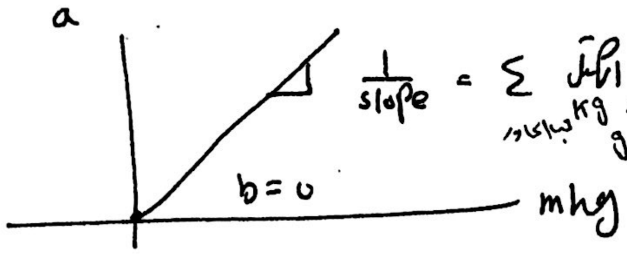


slope = Σ الكتل = $(m_a + m_h + m_g)$ < kg / g]

بحسب المعطى

kg → mhg(N), a(m/s²)

g في الوحدات → mhg(dyne), a(cm/s²)



عند القلب : a

$\frac{1}{slope}$ = Σ الكتل = $(m_a + m_h + m_g)$

بالـ kg او g حسب الوحدات

ملاحظة

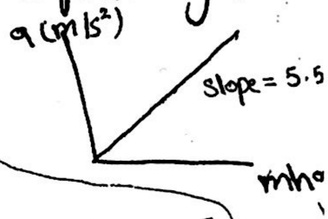
$kg \xrightarrow{*1000} g$

$1N \to 10^5$ dyne

$1kg\,\frac{m}{s^2}$; $g\,\frac{cm}{s^2}$

مهم جداً

Ex: The added and hanging mass are 70g, 60g respectively the the glider mass in g:



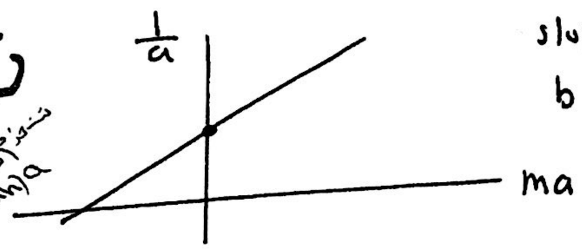
Sol: $\frac{1}{slope} = m_h + m_a + m_g$ * slop = 5.55 Kg

$\Rightarrow \frac{1}{5.55} = 70 + 60 + m_g \Rightarrow 0.18 * 1000 = 130 + m_g \Rightarrow m_g = 50g$

2

في اشتقاق الوس تستخرج قانون

$m_h g = (m_c + m_a + m_h)\, a$



slope = $\frac{1}{m_h g}$

b = $\frac{m_h + m_{cart}}{m_h g}$

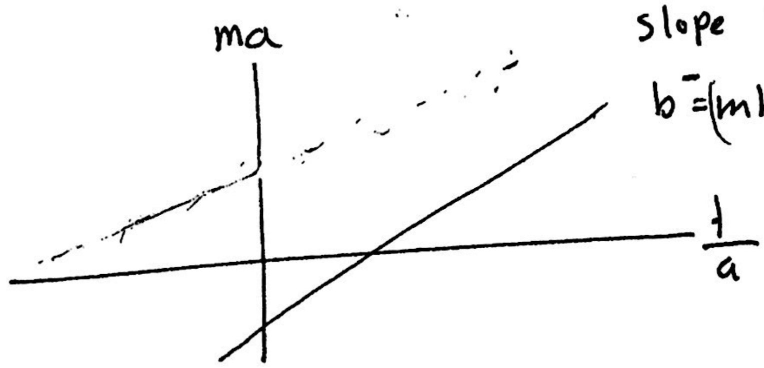
الاشتقاق

$\frac{m_h g}{m_c + m_a + m_h} = a$

$\frac{1}{a} = \frac{m_c + m_a + m_h}{m_h g}$

$\frac{1}{a} = \frac{m_c + m_h}{m_h g} + \frac{m_a}{m_h g}$

y-intercept, slope



slope = $m_h g$

b = $-(m_h + m_g)$

الاشتقاق

$m_h g = (m_a + m_h + m_c)\, a$

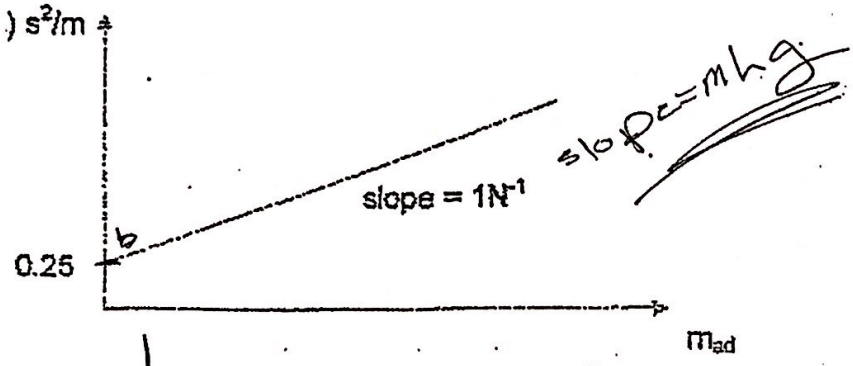
slope

$m_a = \frac{m_h g}{a} - m_h - m_g$

y-intersept

In the "Force and Motion" experiment, if the following figure was obtained. The hanging mass & the mass of the cart (in kg) respectively are:(use g=10ms^{-2}) **(4 marks)**

a) 0.15, 0.1 b) 0.05, 0.06 c) 0.1, 0.06 d) 0.06, 0.05
e) 0.1, 0.15



slope = mhg

* slope = mhg

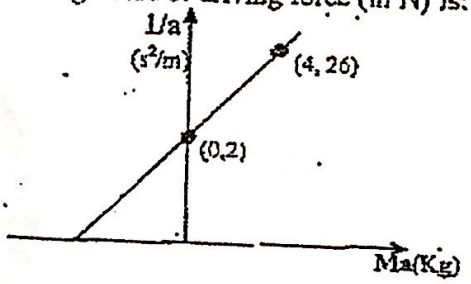
$1 = mh * 10 \Rightarrow mh = 0.1\ kg$

$b = \frac{mh + mc}{mhg} \Rightarrow 0.25 = \frac{0.1 + mc}{0.1 * 10}$

$mc = 0.15\ kg$

** In the force and motion experiment :

8) For a constant driving force and changing added mass . A relation between (1/a) and (Ma) plotted in the graph. The magnitude of driving force (in N) is:
a) 8.0 b) 6.0
c) 0.16 d) 0.13



9) The plot of the acceleration (a) of a cart of mass M_c versus the hanging mass m is:
a) linear b) non-linear c) linear if M>> m for all values.

Solu: driving force = mhg

slope $\Rightarrow$ mhg

$slope = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{26 - 2}{4 - 0} = 6$

driving force = mhg

slope = mhg $\Rightarrow \frac{1}{6} = 0.166$ ∴

(4) C

5) The relation between 1/a (in s^2 /m) and added mass m_a (in kg) is shown in figure (2) for a system consist of a cart that carry a mass and connected to a hanger with constant mass (m_h). The magnitude of driving force (in N) and the mass of cart (in gram) will be respectively: (consider $g = 10\ m/s^2$)

a) 0.5, 90
b) 0.5, 80
c) 0.1, 80
d) 0.1, 90

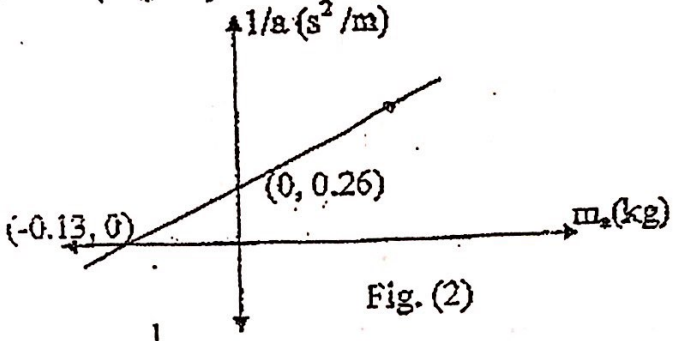


Fig. (2)

1

solu: $slope = \frac{1}{m_h g}$

$* slope = \frac{\Delta y}{\Delta x} = \frac{0.26 - 0}{0 - (-0.13)} = \frac{0.25}{0.13} = 1.923$

$\Rightarrow \frac{1}{1.923} \cong \frac{1}{1.9} = m_h * 10 \Rightarrow m_h = 0.0526\ kg$

$\Rightarrow$

$\Rightarrow$

1) * driving force $= m_h g \Rightarrow 0.0526 * 10 = 0.52 \approx 0.5\ N$

2) $\Rightarrow$ m_{cart} :

$y\text{-intercept} = \frac{m_{cart} + m_h}{m_h g}$

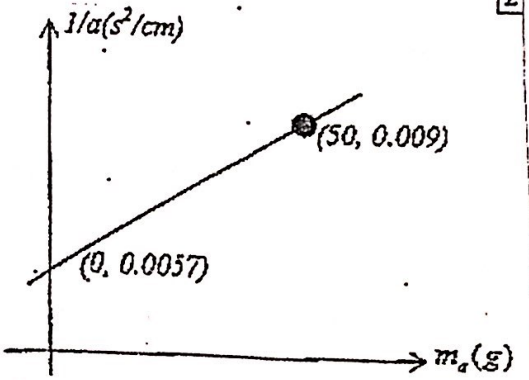
$0.26 = \frac{m_{cart} + 0.0526}{0.0526 * 10}$

$m_{cart} = 0.08\ kg \approx 80\ g$

---

(1)

In the force and motion experiment; a student obtained the following graph, *answer questions 10 and 11 depending on the graph.* 2



10) If the hanging mass (m_h=35g), the value of g (gravitational acceleration) is:

(a) 980.0cm/s²
(b) 432.9cm/s²
(c) 606.1cm/s²
(d) 1000cm/s²

11) From the previous graph, the mass of the car (m_c) is:

(a) 51.4kg
(b) 61.4kg
(c) 51.4g
(d) 61.4g

b = m + mh

0.0057 = M + 35

Solut: 10) mh=35g ⇒

g ?? / slope = mhg

* slope = (0.009 − 0.0057) / (50 − 0) = 6.6 * 10⁻⁵

⇒ 1/6.6*10⁻⁵ = 35 * g ⇒ 15151.1515 / 35 = 35 * g / 35

⇒ g = 432.9 cm/s²

11) mhg / (mc+ma+mh) = g

1/g = (mc+ma+mh)/mhg = (mc+mh)/mhg + 1/mhg · ma

y-intercept = (mc+mh)/mhg ; slope

y-intercept = (mc+mh)/mhg

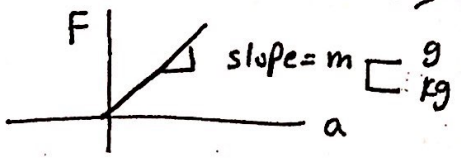
0.0057 = (mc+35)/(35*432)

mc = 51.86 g ≈ 51.4 g

⑤ الجواب

اختصار على رسمات:

F=ma ⇒ قانون نيوتن الثاني



7- Find the mass of the cart from the graph of force vs acceleration for a constant mass system of mass = mass of the cart +100g.

* نختار نقطتين

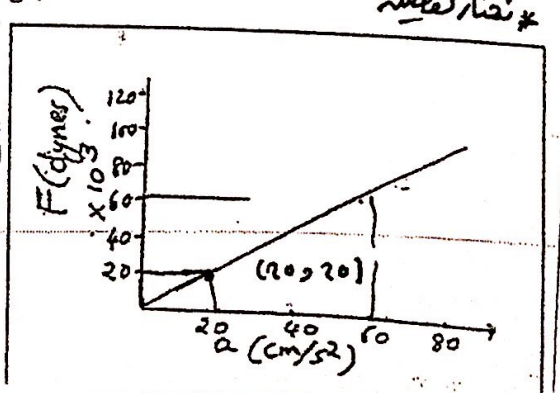
m = m cart + 100

F=ma ⇒ slope = m = Δy/Δx = (y2−y1)/(x2−x1)

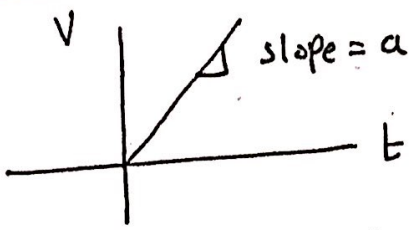
(20*10³ − 0) / (20 − 0) = 1000

⇒ 1000 = m + 100

m cart = 900 g



2]

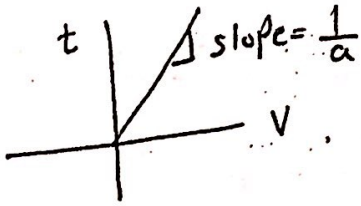


* ملاحظة: دائماً اكل ميل ـ a اكل ـ a اقل

$F = m_b \uparrow a$

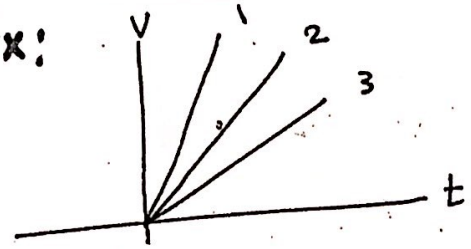
حسب العلاقة

علاقة عكسية



* اكل ميل ـ a اقل ـ a اكل m

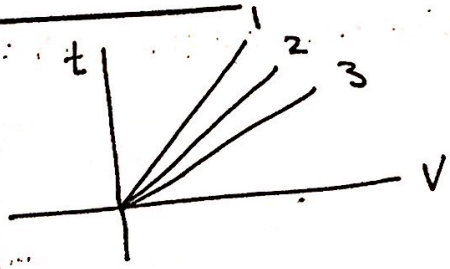
Ex:



$a_1 > a_2 > a_3$

$m_1 < m_2 < m_3$

Ex:



$a_1 < a_2 < a_3$

$m_1 > m_2 > m_3$

* In Force and Motion Experiment; answer questions (4 and 5).

4) The relation between time (in sec) and velocity (in cm/s) is shown in figure (1) for a constant driving force ($m_h g$) and different added masses on the cart. The line that represents largest added mass will be:

a) line 1
b) line 2
c) line 3
d) we can't judge from fig. (1)

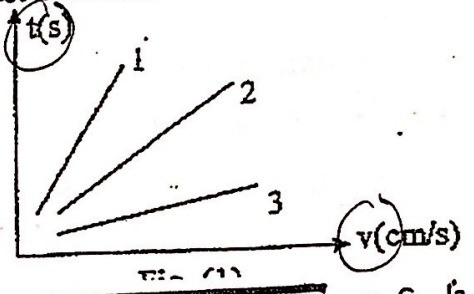
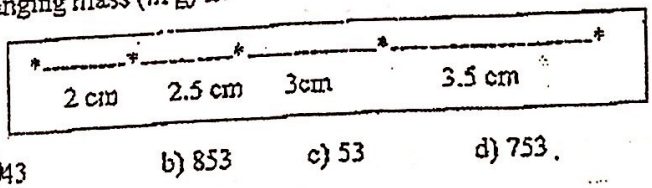


Fig. (1)

تداخل بعربية Kinematic في Force and motion :

10) The ticker tape shown below is for a 800 g cart pulled by a hanging mass m_h. The time interval between any two consecutive points is 0.1s and $g = 980\ cm/s^2$. The hanging mass (in g) is:



a) 43 b) 853 c) 53 d) 753.

$m_{cart} = 800g$

$g = 980\ cm/s^2$

m_h ??

g solution: $m_h g = (m_{cart} + m_h) a$

?? 980 800 ?? .نستطيع إيجادها

t	x
0	0
0.1	2
0.2	4.5

time	V
0→0.1	20
0.1→0.2	25

V	t	a
	0.05	a = 50 ✓
	0.15	

$m_h = 43\,g$:نعوض في المعادلة والجواب النهائي

2] If the $m_h = 5g$, $g = 1000\ cm/s^2$ and the cart acceleration is:
Find the mass of the cart?

Time (sec)	0.05	0.15	0.25	0.35	0.45
Velocity (cm/s)	10	12	14	16	18

$a = \frac{\Delta V}{\Delta t} = \frac{12-10}{0.15-0.05} = 20\ cm/s^2$

solu: $m_h g = (m_{cart} + m_h)\, a$

$5 * 1000 = (m_{cart} + 5) * 20$

$m_{cart} = 245\ g$

6- Force & Motion

A- in this experiment, two taps were obtained. The time interval between two successive points equals = 0.1 sec.

▶ **If the total hanging mass is the same for both tapes, then the added mass to the cart for**

- **Tape B is larger than that for Tape A ( )**
- **The acceleration is constant in Tape A and is negative (F)**
- **If the cart is empty in both cases, then the total hanging weight for Tape B is larger than that for Tape A (F)**

السؤال ناقص لا يجب إعطاء رسمة

EX1 In force and motion experiment (الميزان), we increase the inclination of track to illuminate the normal force that acts on cart (X).
بل نزيد الميزان لمعادل قوة الاحتكاك

EX2 In force and motion, when we increase the load on the cart and driving force is constant, the acceleration of the cart will be constant (X)
لا يستقل ..

8. In the case of the constant total mass of the force and motion experiment; *fig.3* shows the relation between m_h(g) and a/g. The total mass of the system is (in *kg*):

a) *1*
b) *0.5*
c) *1000*
d) *500*
e) *can not be determine*

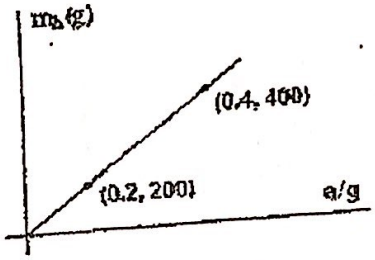


fig.3

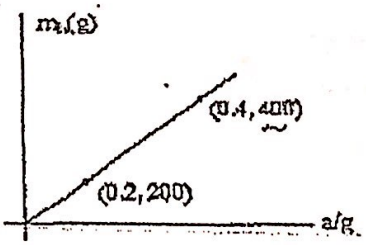
$mhg = (m_a + m_h + m_g)\, a$

$mh = (m_a + m_h + m_g)\, \frac{a}{g}$

total mass = slop = $\frac{\Delta y}{\Delta x} = \frac{200}{0.2} = 1000\ g = 1kg$

7. In the case of the constant total mass of the force and motion experiment; *fig.2* shows the relation between m_h(*in g*) and a/g. The total mass of the system is (in *kg*):

(a) *10*
(b) *1*
(c) *0.5*
(d) *5*
(e) *can not be determine*



نفس السؤال معاد

Q15) The slope of the graph plotted between mg and acceleration represent
a) velocity b) displacement c) mass d) wight

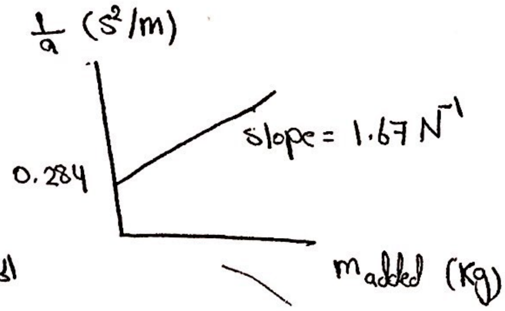
$F = ma$
$mg = m\,a$
slope

EX1 ميد الفصل الأول لسنة 2014

III force and motion exp, a student obtained fig. If the gravitational acceleration $g = 10\ m/s^2$, the hanging mass and the mass of the glider (in g) respectively are:

الخيارات

(a) 60, 110 ✓
(b) 50, 120
(c) 80, 100
(d) 70, 100



الحل:

m_h أولاً ① $\frac{1}{slope} = m_h g$

$\frac{1}{1.67} = m_h * 10$

$m_h = 0.0598\ Kg \approx 0.06\ Kg = 60g$

m_g ② $b = \frac{m_h + m_c}{m_h g} \Rightarrow 0.284 = \frac{0.06 + m_c}{0.6}$

$m_c = 0.1104\ Kg \approx 110g$

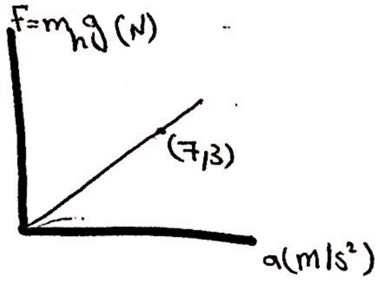
$m_c = m_g$ هنا لم يتحدث عن m_{added} لذلك تهمل

EX ميد الفصل الثاني لسنة 2016

For the fixed total mass and changing driving force, the relation between $m_h g$ (in Newton) and the acceleration is presented in the figure below. The total mass (in gram) is:

الخيارات

(a) 428 ✓
(b) 333
(c) 267
(d) 227



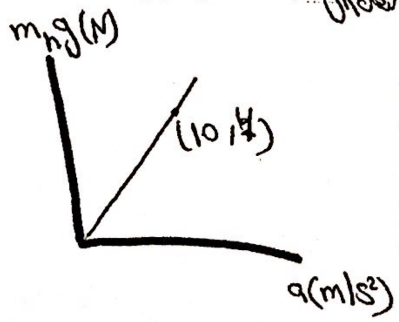
$slope = \frac{3}{7} = 0.428\ kg = 428g$

$F = ma$ ⟸ الفكرة

EX If $m_h = 210g$ and the added mass $= 150g$ then the mass of the glider is: (in g)

(سؤال الصف العاشر لسنة 2016)

الخيارات (a) 40 ✓ (b) 80 (c) 60 (d) 140 (e) 100



الحل ⟸

- $F = ma$

$m_h g = ma$

$slope = \frac{4}{10} = 0.4\ kg$

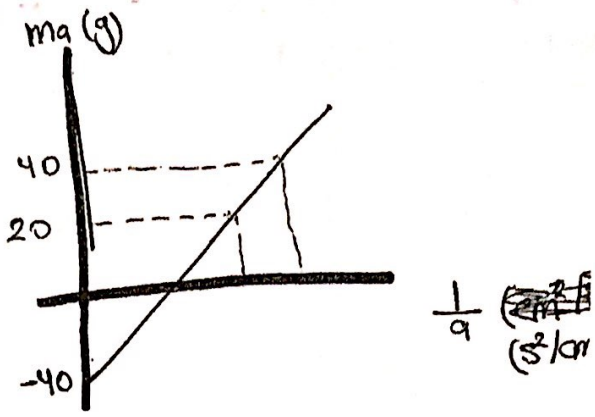
- mass of the system $= 0.4\ kg$

$150 + 210 + m_g = 400g \Rightarrow \boxed{m_g = 40g}$ #

EX - From $(m_a - \frac{1}{a})$ graph in figure the hanging mass and the glider mass respectively are:

فاينل الدور الاول + الثاني 2016

فاينل الدور الثاني 2016



- according to $(m_a - \frac{1}{a})$ graph If the Added mass is 250g then the acceleration in (m/s^2) is:

ملاحظة ⟸ الأرقام على كود X غير واضحة من التصوير
ولكن سأكتب طريقة الحل (السؤال مهم جداً)

اول فرع
① $m_h \Rightarrow$ slope $= \frac{?}{m_h g}$
② $mg \Rightarrow$ $b = -(m_h + m_g)$

تم استخراجهم في ملف صفحة في التلغرام

ثاني فرع $[(m_h + m_g + m_q)a = m_h g$ نعوض في القانون

EX In the Force and motion exp, which of the following statements is correct:

صيد الفصول الأولى لسنة 2015

الخيارات

① The acceleration is inversely proportional with the hanging mass at constant driving force

② The acceleration is directly proportional with the glider mass at constant total m

③ The acceleration is inversely proportional with the driving force at constant total ma.

④ The acceleration is directly proportional with the driving force at constant total mass. (circled)

$F = m_{tot}\, a$ (tot → constant)

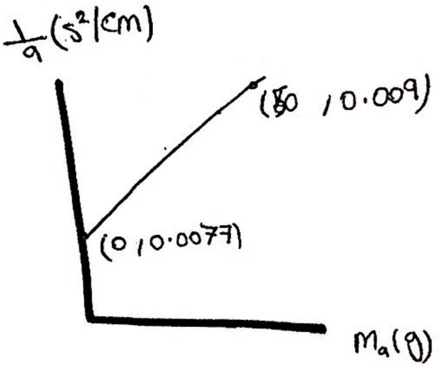
لأنه

إذا العلاقة بين F و a طردية

EX A student obtained the following graph, Find the mass of the glider (M) in g:

صيد الفصول لسنة 2015

الخيارات



ⓐ 70.90   ⓑ 123.47

ⓒ 256.90 (boxed)   ⓓ 42.79

① $b = \frac{m_h + m_c}{m_h g} \Rightarrow 0.0077 = \frac{38461 + m_c}{38461}$

$m_c = 257.6\,g \approx \underline{256.90}$ #

② $m_h \Rightarrow \frac{1}{slope} = m_h g$

$\frac{50}{0.009 - 0.0077} = m_h * 1000 \Rightarrow m_h = 38461\ g$

ملاحظة: الأرقام في السؤال عدلوا منه بشكل كامل لذلك لم يخرج معنا الخيار الكامل بالضبط

$m_c \rightarrow m_g$ (تزداد / تقل)

EX When the mass of the glider increases, then glider arrive with acceleration:

فاينل الصيفي الأول + الثاني لسنة 2016

ⓐ more quickly

ⓑ more slowly (circled)

ⓒ Independently

ⓓ All of the above

ⓔ at the same rate

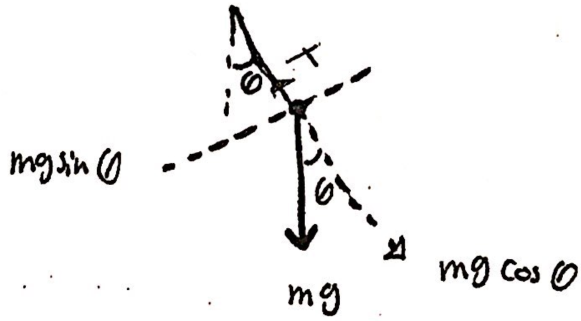
لأن العلاقة عكسية مع a

Experiment (8)

Simple Harmonic motion

Ex 8: Simple harmonic motion:

$\theta \leq 15°$ ← السبب: حتى تكون $\theta \approx \sin\theta$



$\Rightarrow \Sigma F = ma$ حسب قانون نيوتن الثاني

y-axis

$T - mg\cos\theta = ma_c \Rightarrow a_c$: التسارع المركزي

x-axis

$mg\sin\theta = ma_t \Rightarrow a_t$: tangent تسارع مماسي

$\Rightarrow$ The only force acting on simple pendulum: $-mg\sin\theta$ (storing force)

* في هذه التجربة يوجد قانونين مهمات:

1 $T_{period} = 2\pi\sqrt{\frac{L}{g}}$

T_{period} : الزمن الدوري اللازم لإتمام دورة كاملة بوحدة (sec)

g : الجاذبية الارضية ولازم ما نعوضها من عنا

اما أن تعطى في السؤال / نقوم على إيجادها.

* Remark: L , g

L → cm / → g : cm/s^2

L → m / → g : m/s^2

2 $N = \frac{t}{T_{period}}$

N : noumber of oscillations عدد الذبذبات

t : الزمن الكلي بوحدة (sec)

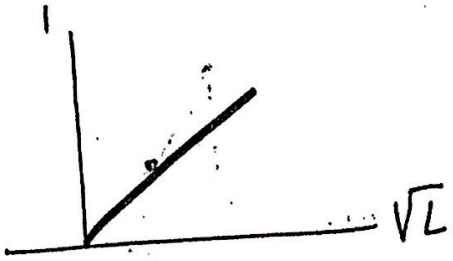
* الرسمات المطلوبة لهذه التجربة: نستعين بالقانون:

$T_{period} = 2\pi\sqrt{\frac{L}{g}}$

1

العلاقة طردية * غير خطية.
(علاقة جذرية)

2



$b = zero$

$slope = \frac{2\pi}{\sqrt{g}}$

طريقة إيجاد الـ slope :

① $T = 2\pi\sqrt{\frac{L}{g}}$ ② $y = mx + b$ ③ $y \to T$

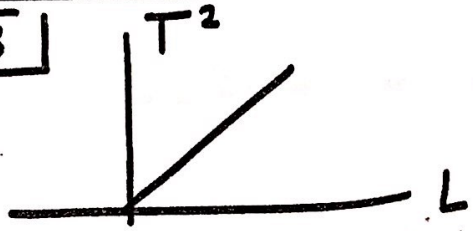
$\sqrt{L} \to x$

$m \to \frac{2\pi}{\sqrt{g}}$

$b = zero$

(بالمقارنة مع معادلة الخط المستقيم)

3



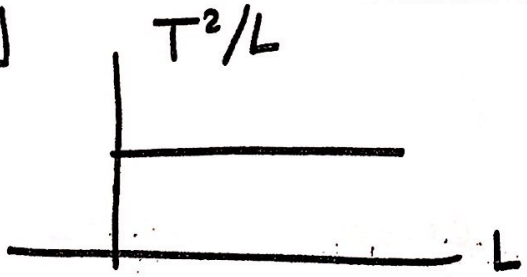
$b = 0$

$slope = \frac{4\pi^2}{g}$

$T = 2\pi\sqrt{\frac{L}{g}} \Rightarrow$ نربع الطرفين $\Rightarrow T^2 = \frac{4\pi^2}{g} L$

T^2 → y ، L → x ، $\frac{4\pi^2}{g}$ → slope = b

4



$slope = 0$

$b = \frac{4\pi^2}{g}$

توضيح: $T = 2\pi\sqrt{\frac{L}{g}} \Rightarrow$ نربع $\Rightarrow T^2 = 4\pi^2 \frac{L}{g} \Rightarrow \frac{T^2}{L} = \frac{4\pi^2}{g} + 0L$

y ، b ، $slope = 0$

ذاكر يا بني سؤال على أحد الأوجه الخمسة ← الشكل الصحيح للرسم ← او طبيعة g من خلال الـ slope او الـ b

(٥)

Simple Harmonic motion (Simple pendulum):

6] A simple pendulum 12 m in length oscillates in a location where g=10 m/s². The number of oscillations in 10 minutes?

a) 2.5 b) 123
c) 87 d) 149

7] If the ratio between two pendulum lengths is $L_2/L_1 = 16$, then the ratio between two periods T_1/T_2 is:

a) 1/9 b) 9
c) 1/5 d) 1/4

6] $L = 12m$, $g = 10 m/s^2$, $t = 10 min$, N??

$$N = \frac{t}{T_{period}} = \frac{10 * 60}{6.87} = 87.3 \cong 87$$

$$T_{period} = 2\pi\sqrt{\frac{L}{g}} = 2\pi\sqrt{\frac{12}{10}} = 6.87\ sec$$ ج فرع

7] $\frac{L_2}{L_1} = 16$, $\frac{T_1}{T_2} = ??$

$$Sol: \frac{T_1}{T_2} = \frac{2\pi\sqrt{\frac{L_1}{g}}}{2\pi\sqrt{\frac{L_2}{g}}} \Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{L_1}{L_2}} =$$

$$\Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{1}{16}} = \boxed{\frac{1}{4}}$$ د فرع

1) SHM: In simple pendulum experiment, the linear graph is plotted between
a) T and L b) T^2 and L c) T and L^2 d) T^2 and L^2

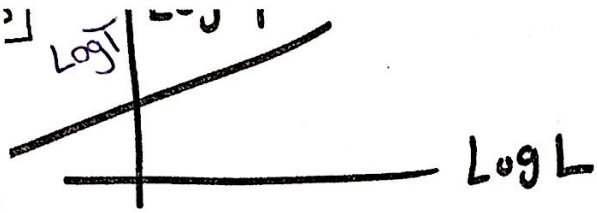
T الزمن

2) SHM: When the length of the simple pendulum increases
a) the mass of the ball will increase b) the speed of the ball will increase
c) the period will decrease d) the period will increase

1) b) T^2 and L

2) c) The Period Will ~~decrease~~ Increase.

L ∝ T



slope = 0.5

$b = \frac{1}{2} \log \frac{4\pi^2}{g}$

الطريقة ولكنه مفضل ↑ اسهل :

$T^2 = 4\pi^2 \frac{L}{g} \Rightarrow \log T^2 = \log \frac{4\pi^2 L}{g} \Rightarrow \log T^2 = \log \frac{4\pi^2}{g} + \log L$

$\Rightarrow 2 \log T = \log \frac{4\pi^2}{g} + \log L \Rightarrow \log T = \frac{1}{2} \log \frac{4\pi^2}{g} + \frac{1}{2} \log L$

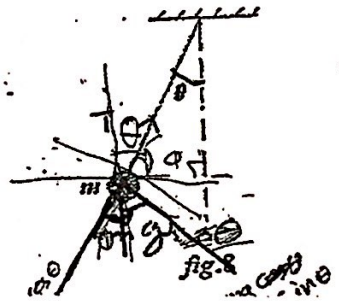
y = b + slope × x

m > 0
b > 0

---

13. The only force acting on the simple pendulum in our experiment is:

a) $-mg \sin\theta$
b) $-mg \cos\theta$
c) T
d) Both (a) and (c) are correct

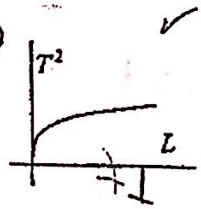


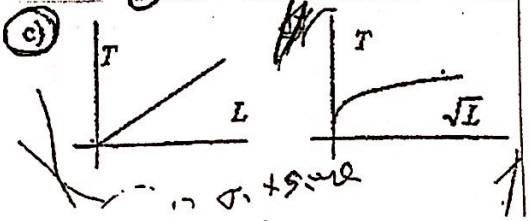
الإجابة d

---

14. Which of the following graphs represents correctly the relation between the periodic time T (in sec) and the length of the pendulum L (in cm)?

a)


b)


c)


الإجابة a

12. *Fig.7* is obtained by a student from the simple pendulum experiment, from this graph the gravitational acceleration (in cm/s^2) is:

1)

a) *714.1*
b) *1606.8*
c) *40.1*
d) *26.7*

$g = \frac{4\pi^2}{slope}$

العواب a

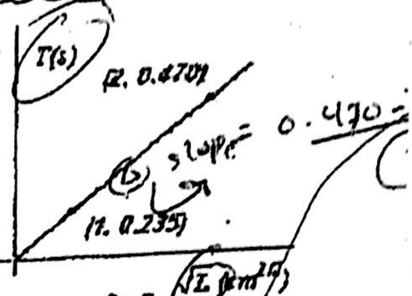


fig.7

13. In the simple pendulum experiment, *fig.8* shows the relation between *T* and *L*. The value of L_2 is (in *cm*):

2)

a) *14.7*
b) *21.7*
c) *10.8*
d) *29.5*

$T = 2\pi\sqrt{\frac{L}{g}}$

period of ossoliatiur

العواب d

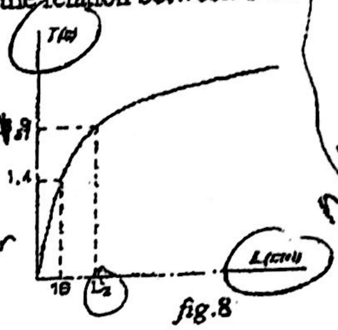


fig.8

$1.4 \rightarrow 16$ cm

not

* 1) slope $= \frac{\Delta y}{\Delta x} = \frac{0.470 - 0.235}{2 - 1} = 0.235$

$\Rightarrow$ slope $= \frac{2\pi}{\sqrt{g}} \Rightarrow \frac{0.235}{1} = \frac{2 * 3.14}{\sqrt{g}} \Rightarrow \frac{2 * 3.14}{0.235} = \sqrt{g}$

$\Rightarrow g = 714.14 \ cm/s^2$

2) Sol: $T_2 = 2\pi\sqrt{\frac{L_2}{g}} \Rightarrow \therefore 1.9 = 2 * 3.14\sqrt{\frac{L_2}{g??}}$

$\Rightarrow 1.9 = 2 * 3.14\sqrt{\frac{L_2}{321.957}} \Rightarrow L_2 = 29.47 \cong 29.5$ فرع d جواب

$\Rightarrow T_1 = 2\pi\sqrt{\frac{L_1}{g}} \Rightarrow 1.4 = 2 * 3.14\sqrt{\frac{16}{g}} \Rightarrow g = 321.957 \ cm/s^2$

21) **Error analysis:** Suppose that we measure g, the acceleration of gravity, using a simple pendulum. If L is the length of the pendulum and T is the period then $T = 2\pi\sqrt{\frac{L}{g}}$. Suppose we measure the period T for one value of the length L and get the result, L=92.95 ± 0.1 cm and T= 1.936 ± 0.004 seconds. The fractional uncertainty in our answer for g is

a) 0.4% b) 0.2% c) 0.1% d) 0.3%

مسائل المقدمة الجواب b

$\Delta g = g\sqrt{\left(\frac{\Delta L}{L}\right)^2 + \left(\frac{2\Delta T}{T}\right)^2}$

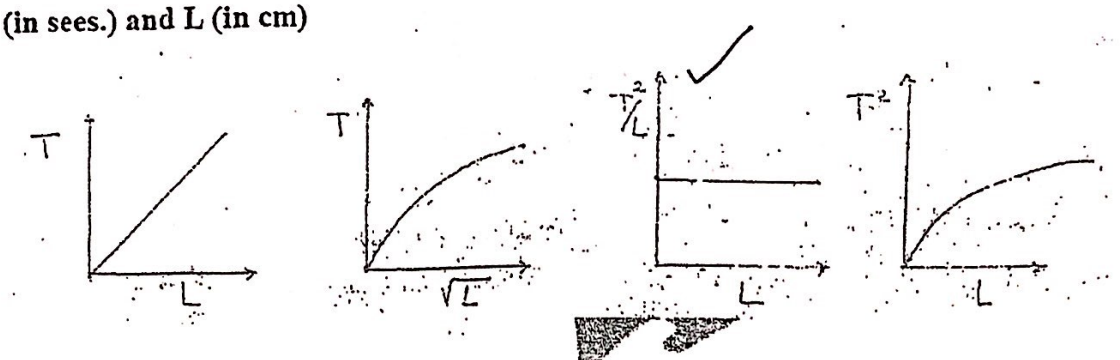
$= 0.2\%$

$T^2 = 4\pi^2 \frac{L}{g}$

$g = 4\pi^2 \frac{L}{T^2}$

SIMPLE PENDULUM:

1- Which of the following graphs represents correctly the relationship between T (in sees.) and L (in cm)



2- If we plot log T vs log L where T is the period and L is the length of the pendulum, the slope will be:

a) $-\frac{1}{2}$ b) $\frac{1}{2}$ c) log $\frac{2\pi}{\sqrt{g}}$ d) log $\frac{4\pi^2}{g}$

3- The pendulum is set to oscillate through a small angel (about 5 degrees). Why?

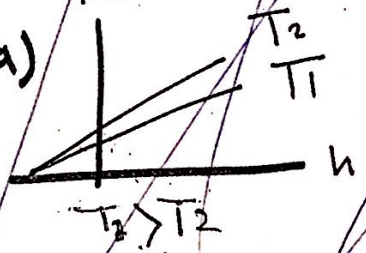
لانه عند زاوية صغيرة تكون ($\theta \approx \sin\theta$)

4- How dose one increase the accuracy of finding T (time period) in this experiment? by increasing the number of oscillations

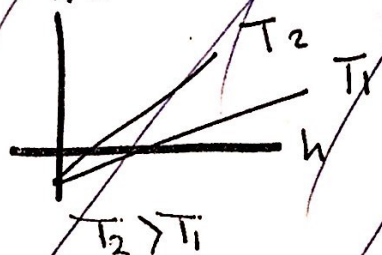
Which graph is correct

Ex: $T_1 > T_2$

a)

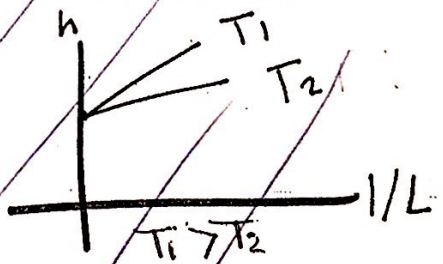


b)

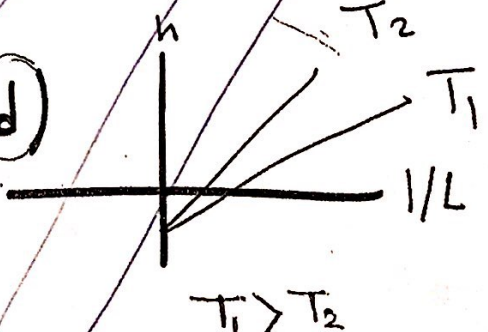


(2)

c)



d)



لانه في الميل الموجب كلما نزلنا للاسفل يزيد الميل

11- Simple Pendulum:

In this experiment , increasing the number of oscillations of the which the time interval is measured.

a) Causes the measured value of g to increase.

b) Causes the measured value of g to decrease.

(c) Has no effect on the measured value of g.

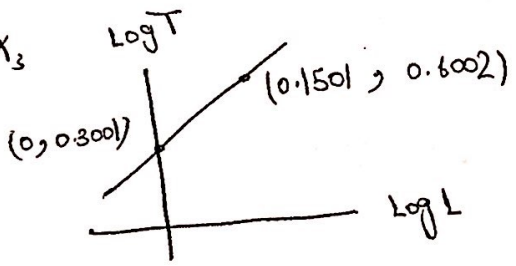
الإجابة (c)

True or false أسئلة

Ex1 In simple harmonic motion , the angle used must be less than 50° (

Ex2 In simple harmonic motion, the particle moves back and forth over the same path (✓)

Ex3



Find g?

$$b = \frac{1}{2}\log\frac{4\pi^2}{g}$$

$$0.3001 = \frac{1}{2}\log\frac{4\pi^2}{g}$$

$$10^{0.3001} = 10^{\frac{1}{2}\log\frac{4\pi^2}{g}}$$

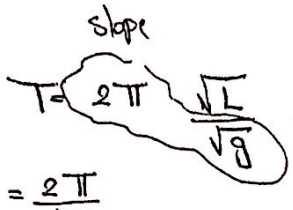
$$10^{0.3001} = 10^{\log\left(\frac{4\pi^2}{g}\right)^{\frac{1}{2}}}$$

$$10^{0.3001} = \sqrt{\frac{4\pi^2}{g}} \Rightarrow g = 9.9\ m/s^2$$

Ex Fig (3), is obtained by student from the simple pendolum exp, from the graph the gravitational acceleration in (cm/s^2) is:

ⓐ 1058.77 ⓑ 993.57

ⓒ 927.47 ⓓ 1020.66



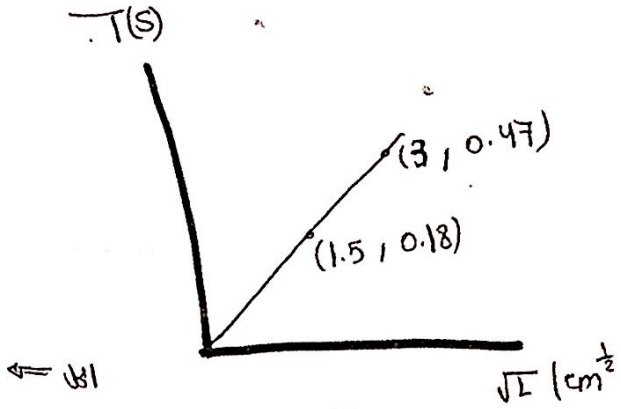


Fig (3)

$$\text{slope} = \frac{0.47-0.18}{3-1.5} = \frac{2\pi}{\sqrt{g}}$$

$$\frac{0.29}{1.5} = \frac{2\pi}{\sqrt{g}} \Rightarrow g = 1058.7\ cm/s^2$$

Ex The relation between periodic time (T) and length of pendolume (L) is given by $T = c\sqrt{L}$ where (c) is constant. For a certain length the period is (1 sec). If the length is doupled, then the periodic time becomes:

ⓐ 2.0 ⓑ 707 ⓒ 1.732 ⓓ 1.414

$L_2 = 2L_1$

$T_2 = c\sqrt{L_2}$

$T_2 = c\sqrt{L_2}$ ---①

$T_1 = c\sqrt{L_2}$

$= c\sqrt{L_1}$ ---②

$g_{moon} = \frac{g_{earth}}{6}$

$$\sqrt{\frac{L_2}{L_1}} = \frac{1}{T_1}$$

$$\sqrt{\frac{2L_1}{L_1}} = \frac{T_2}{1} \Rightarrow \sqrt{2} = T_2 \Rightarrow T_2 = 1.4142\ sec$$

Ex the acceleration due to gravity on the moon is approximately 6 times smaller than the earth, Simple pendulum with Length (L) is moved from the earth to the moon, then which statement is correct.

ⓐ the pendulum will swing on moon 6 times faster than on earth.

ⓑ the pendulum will swing on moon 6 times slower than on earth

ⓒ the pendulum will swing on moon 2.5 faster than on earth

ⓓ the pendulum will swing on moon 2.5 slower than on earth.

$$N_{moon} = \frac{t}{T_{period}} \quad \cdots ①$$

$$N_{earth} = \frac{t}{T_{period}} \quad \cdots ②$$

نقسم المعادلتين : على اعتبار أنه سوف نأخذ نفس الوقت للتجربة

$$\frac{N_{moon}}{N_{earth}} = \frac{\frac{t}{T_{period\,moon}}}{\frac{t}{T_{period\,earth}}} = \frac{T_{period\,earth}}{T_{period\,moon}}$$

$$T_{period\,earth} = 2\pi\sqrt{\frac{L}{g_{earth}}} = \sqrt{\frac{g_{moon}}{g_{earth}}}$$

$$2\pi\sqrt{\frac{L}{g_{moon}}} = \sqrt{\frac{6\,g_{earth}}{g_{earth}}} = \;?$$

$$\frac{N_{moon}}{N_{earth}} = 2.5 \Rightarrow$$

Ex For a simple pendulum, If you plot Log(T) versus Log(L) you will have a straight line, The slope and y-intercept of the Line respectively are :

فايل الدورس الثاني 20/5 لسنة

ⓐ 0.6 , 0.8 ⓑ 0.5 , 0.3 ⓒ 0.3 , 0.5 ⓓ 0.7 , 0.6

الـ slope كما اشتقيناها في التجربة = 0.5

والـ y-intercept اللوغاريتم 0.3 لأنه الوحيد موجود بالخيار

0.5 slope

Experiment (9)

The Behavior of gases with changes In temprature and pressure.

(gas Laws)

Exp9: The Behavior of Gases with Changes in Temp. and pressure

⇒ gas law (Boyl's law)

القانون العام

$$\frac{P_1 V_1}{n_1 R T_1} = \frac{P_2 V_2}{n_2 R T_2}$$

((at constant T))

$P_1 V_1 = P_2 V_2 = nRT$
(Boyle's Law)

- P: pressure (mmHg) الضغط
- V: Volume
- n: no of moles
- T: Temper
- R: Constant.

*قاعدة: أي نقطتين خلال نفس المائع وعلى نفس الارتفاع لهم نفس الضغط
سائل / غاز :

*عند تثبيت درجة الحرارة: ⇐ $P_1 V_1 = P_2 V_2$

قانون بويل : $PV = \text{constant} = nRT$

*أنواع الضغط :

⇒ Pa: atmospheric pressure : أي نقطة مفتوحة ومعرضة للهواء بتاخد ضغط جوي

⇒ Pgas : pressure of Conflied gas : ضغط الغاز المحصور

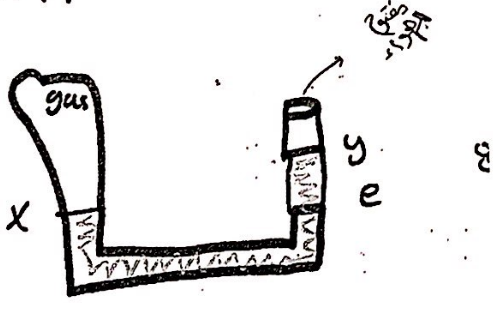
⇒ h: ضغط السائل.

جهاز قياس الضغط : manometer

*حتى نعرف الضغط المؤثر على النقطة المطلوبة دائماً ننظر إلى ما فوق النقطة :

- c: Pgas : نقطة !! ما فوقها فقط غاز محصور
- b: Pa
- a ⇒ h + Pa ل وأيضاً ضغط جوي.

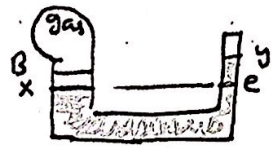
Ex:



$h = y - e$ حسب المثال ع السائل)

سؤال ⇐ EX Boyle's Law shows that t
to its volume at consta

* الاستقامة الرسمات :



لطبق قانون بويل على النقطة e

$e: \Rightarrow PV = C_1$

$\Rightarrow (h + P_a) V = C_1$

$\Rightarrow h + P_a = \frac{C_1}{V}$

$\Rightarrow h = \frac{C_1}{V} - P_a$ ← يجب حفظ هذا القانون

$\Rightarrow h = \frac{C_1}{V} - P_a$ بدنا نشتغل على النقطة [e]

$\Rightarrow V = AL$

$\Rightarrow h = \frac{C_1}{AL} - P_a$: $\Rightarrow$ $h = \frac{C_2}{L} - P_a$ ← يجب حفظ هذا القانون

* رسمة بيانية والتنقل بجوتها على القانون :

(1)

$\Rightarrow h = \frac{C_2}{L} - P_a$

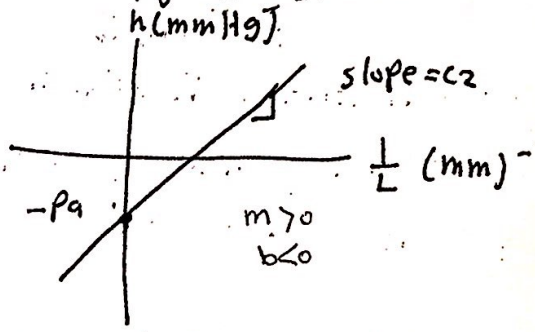
$\Rightarrow y = mx + b$

$y : h$

* $m = \text{slope} = C_2$

$x = \frac{1}{L}$

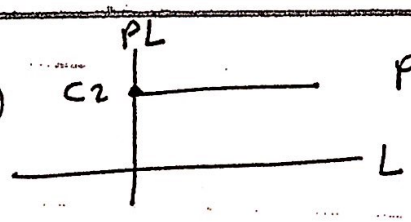
* $b = -P_a$ (التقاطع مع الصادات)



هذه الرسمة مهمة

طريقة نوع آخر من الرسمات :

(2)



$PV = C_1$

* $PV = C_1$

$P\,AL = C_1$

$P\,L = \frac{C_1}{A}$

$\boxed{PL = C_2}$

$y = mx + b$

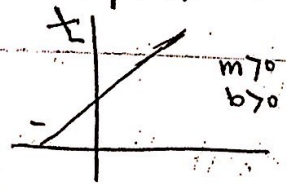
$PL = 0L + C_2$

slope = zero

* Line parallel to L-axis

مقارنة مع معادلة الخط المستقيم :

(3)



(2)

$h = \frac{C_2}{L} - P_a$

$\frac{1}{L} = \frac{1}{C_2} h + \frac{P_a}{C_2}$

slope $= \frac{1}{C_2}$

y-intercept $= \frac{P_a}{C_2}$

9. In the Boyle's law experiment, if the atmospheric pressure P_a= 700mmHg. What is the value of L when h=37.5cm?

a) 13.9cm
b) 18.6cm
c) 2.6cm
d) 2.7cm

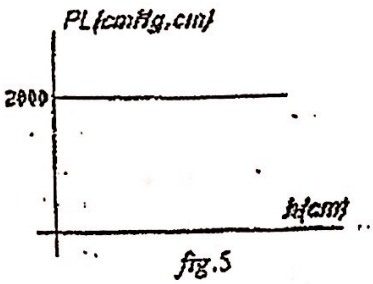


fig.5

10. In the Boyle's law experiment, the relation between h (in *Pascal*) and $1/V$ (in m^{-3}) is shown in *fig.6*. The atmospheric pressure (in *Pascal*) is:

a) 0.8
b) -0.8
c) -0.9
d) 0.9

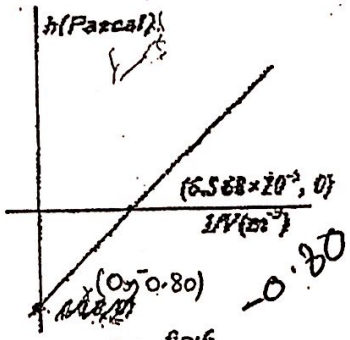


fig.6

11. Depending on *fig.6*, if the number of moles n=5*moles* and the Universal Gas Constant R=8.314*J/mole.K*, then the temperature of the gas is:

a) 329°C
b) 56°C
c) 293°C
d) 20°C

a) Solu: $C_2 = b$ & slope $= n$ ⇒ $h = \frac{C_2}{L} - P_a$ ⇒ $37.5*10 = \frac{2000}{L} - 700$ ⇒ $L = 1.86\,h$

10) $PV = nRT$ ⇒ $P = \frac{nRT}{V}$ ⇒ $(h + P_a) = \frac{nRT}{V}$

$h = \frac{nRT}{V} - P_a$

y-intercept $= -P_a$

$-0.8 = -P_a$

#⑨ $P_a = 0.8$ Pascal

$h \Rightarrow y$

$\frac{1}{V} \Rightarrow x$

slope $\Rightarrow nRT$

y-intercept $\Rightarrow -P_a$

11) slope $= nRT$

$\frac{\Delta y}{\Delta x} = 5*8.314$

$\frac{0 - -0.8}{10^{-5} * 6.56 - 0} = 5*8.314$

$0.12 * 10^5 = 5*8.314$

$T = 293.3\,K$

⑥ ✓

3- Two readings were taken for h (the difference between the two mercury levels) and L (the length of the enclosed gas) as shown in the table.

h (cm Hg)	40.0	12.8
L (cm)	15.0	20.0

The atmospheric pressure is _____

$h = C_2/L - P_a$

Solu: $40 = C_2/15 - P_a$ --- (1)

$12.8 = C_2/20 - P_a$ --- (2)

$-40 = -C_2/15 + P_a$

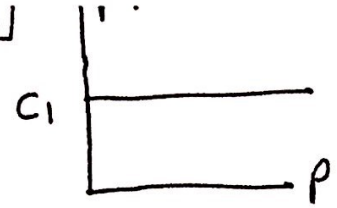
$12.8 = C_2/20 - P_a$

$40 = \frac{-1628.7}{15} - P_a$

$P_a = -2228.7$ Pascal

Pa??

4



* parallel to P-axis
* $PV = C_1$

مقارنة ⇒ $y = mx + b$

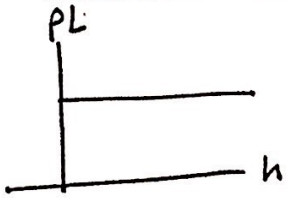
$PV = 0P + b$

b b b

y m x

y-intercept

5



slope = 0

$b = c_2$

Line parallel to h-axis

$PV = C_1$

$PAL = C_1$

$PL = \frac{C_1}{A}$

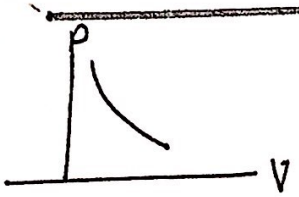
$PL = C_2$

$y = mx + b$

b ← C_2

zero

6



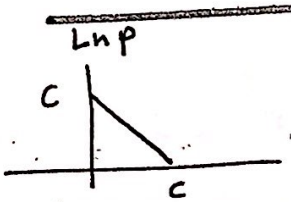
عكسية العلاقة

ملاحظة للتحويل:

cm *10 ← mm

---

7 b



$PV = C$

$\ln PV = C$

$\ln P + \ln V = C$

$\ln P = C - \ln V$

slope = -1

y inter = C

X

(1) Boyle's law can be written as:

(a) PV= constant (b) P/V=constant

(c) V/T=constant (d) VT=constant

الجواب

$PV = Constant$

---

17. If the tube in *fig.7* was filled by mercury and the atmospheric pressure is *760 mmHg*, find the pressure of the confined gas.

(a) 810

(b) 785

(c) 750

(d) 725

Solut: $P_x = P_e$

$P_{gas} = h + P_a$

$P_{gas} = (80 - 30) + 760$

$P_{gas} = 810$ mm Hg

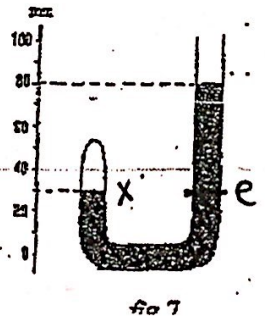


fig 7

X

8- Gas Laws:

B) A change of atmospheric pressure during the experiment:

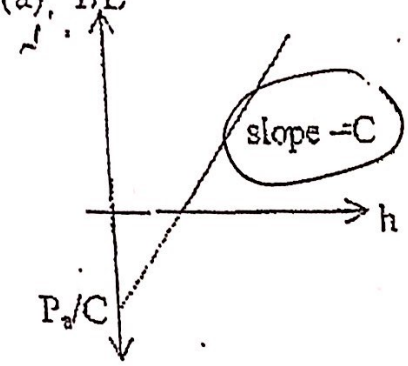
(a) Would affect the results of the experiment.

b) Would have no effect on the results of experiment.

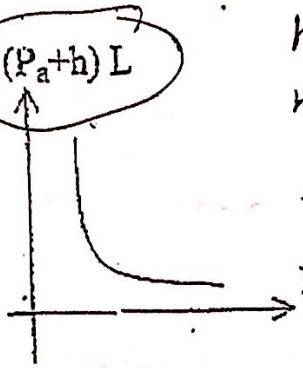
الإجابة (a)

2) Which of the following graphs is correct for Boyle's law. If P, V and P_a represent the pressure(in cm Hg), volume of gas (cm^3) and atmospheric pressure (in cm Hg):

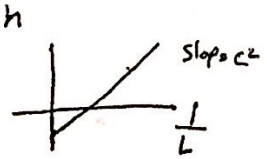
(a) 1/L



(b) $(P_a+h)\,L$

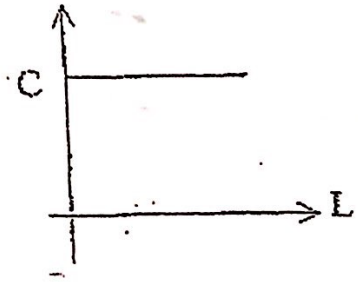


$h = \frac{c_2}{L} - P_a$



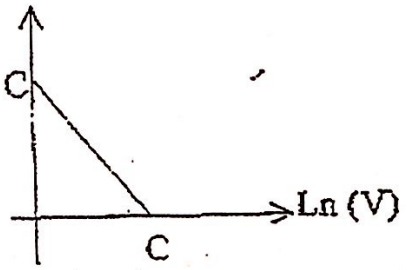
$c_2 = C$ لهنا في حالة

(c) (P_a+h)



$h = \frac{c_2}{L} - P_a$

(d) Ln (P)



الرسمة الصحيحة d وقد تم ذكر ذلك سابقاً

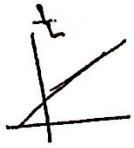
أما سبب أخطاء الرسمات a و b و c

a: $h = \frac{c_2}{L} - P_a \Rightarrow \frac{h+P_a}{c_2} = \frac{1}{L}$ بالتالي

$\Rightarrow \frac{1}{L} = \frac{h}{c_2} + \frac{P_a}{c_2}$ → التقاطع

y ↵ x ↵

slope= c_2



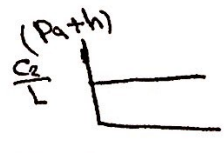
ولكن في الرسمة كتب c والرسمة الصحيحة

---

b: $h = \frac{c_2}{L} - P_a \Rightarrow \frac{(h+P_a)}{1} = \frac{c_2}{L} \Rightarrow (h+P_a)L = c_2 + 0L$

$(P_a+h)L$ الرسمة الصحيحة. الرسمة خطأ. slope= c_2

$\therefore (P_a+h) = \frac{c_2}{L} + 0L$ ✱ $\frac{c_2}{L}$ التقاطع



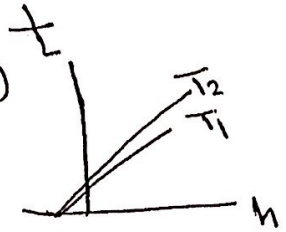
والرسمة b ∴ m=0

---

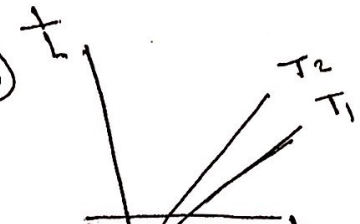
d: تم ذكرها سابقاً

EX Which graph is correct ... If $T_1 > T_2$

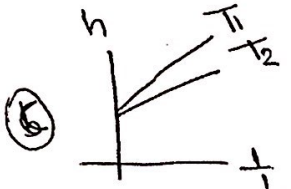
(a)



(b)

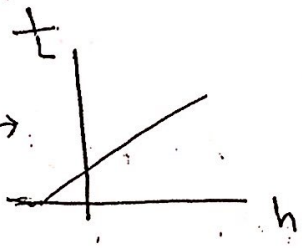


(c)



(d)

الحل: ثم شرحها سابقاً

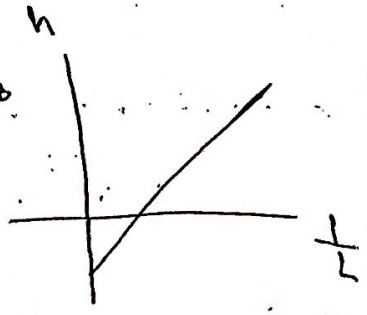


← رسمها الصحيحة

والميل دائماً في حال كان الـ y-intercept موجباً كلما ارتفعنا للأعلى يزداد الميل

لذلك في رسمة (a) ← الويه موجبة ولكن $T_2 < T_1$

رسمة (b) ← الويه حادة خاطئة أصلاً



← رسمها الصحيحة

ثم شرحها سابقاً

والميل دائماً في حال كان الـ yintercept سالباً كلما نزلنا للأسفل يزداد الميل

لذلك في رسمة (c) ← الويه أصلاً خطأ

(d) ← الويه موجبة و $T_1 > T_2$

⇒ أسئلة أخرى ص 8

الإجابة (d) #

True or False:

Write True (T) or False (F) for each statement (each one has 2 mark)

1) In Kinematics experiment, the tape represents the distance only. (X)

2) The unit of heat capacity is Calory. (X)

3) The parallex is considered as random error. (X)

4) The error in measuring the diameter of cylindrical rod once using a micrometer is 0.005 mm. (✓)

5) Boyle's law shows that the pressure of a gas is inversely proportional to its volume at constant temperature. (✓)

6) The specific heat capacity depends on the type of material. (✓)

7) In force and motion experiment, we increase the inclination of track to illuminate the normal force that acts on cart. (X)

8) We can get the resultant force (القوة المحصلة) and equilibrant force (القوة الموازنة) directly from the force table (vectors). (✓)

9) In simple harmonic motion, the angle used must be less than 50. (✓)

10) In elastic collision (تصادم مرن), the momentum and kinetic energy are conserved because the system is isolated. (X)

11) In force and motion experiment, when we increase the load on the cart and the driving force is constant, the acceleration of cart will be constant. (X)

12) In simple harmonic motion, the particle moves back and forth over the same path. (✓)

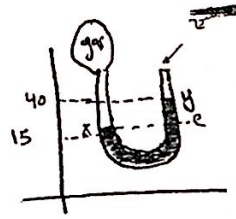
1- Write the word **"True"** if the statement is true, and the word **"False"** if the statement is false: **(4 marks)**

T a) The rate of change of position is called average velocity. ✓
T b) When two or more forces act simultaneously at a point on an object, the single force applied at the same point that would produce the same effect is the resultant force. (T)
F c) When the velocity of a body increases or decreases the same amount in successive units of time, the velocity is uniform. (F)
T d) In the force and motion experiment, the driving force is $F = ma$ where m is the total mass of the system (i.e. $m = m_c + m_a + m_h$).

$V_{Avg} = \frac{\Delta X}{\Delta t}$

(✓) driving force $= ma = mhg$
$= (m_c + m_a + m_h)a$

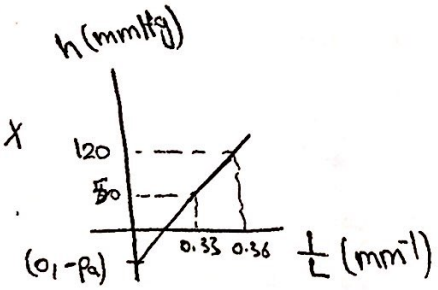
EX



$P_a = 750$ mmHg
Find the pressure of the confined gas?

$P_X = P_e$
$P_{gas} = P_a + h$
$= 750 + (40 - 15)$
$= 750 + 25 = 775$ mmHg #

EX



Find P_a? (the atmospheric pressure)

$h = \frac{C}{L} - P_a$

y-intercept $= -P_a$ لأنه

slop = slop
(0.33, 50) & (0, -Pa) (0.36, 120) & (0.33, 50)

$\frac{\Delta y}{\Delta x} = \frac{\Delta y}{\Delta x}$

$\frac{50 - -P_a}{0.33 - 0} = 2333.3$ ⟵

$P_a = 720$ mmHg

11. In the Boyle's law experiment, if the atmospheric pressure $P_a = 700mmHg$. What is the value of L when $h=37.5cm$?

a) *13.9cm*
b) *18.6cm*
c) *2.6cm*
d) *2.7cm*
e) *can not be determine*

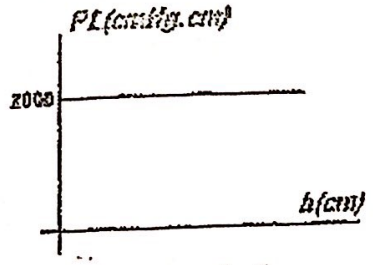


fig.6

$PL = \underbrace{C_2}_{\text{y-intercept}} + Oh$ // $P_a = \frac{C_2}{L} - h$

$70 = \frac{2000}{L} - 37.5$

$107.5 = \frac{2000}{L}$

$L = 18.6cm$

b حل

10. In the Boyle's law experiment, the following graph was obtained. The value of P_2 will be:

a) *200*
b) *300*
c) *1200*
d) *1800*

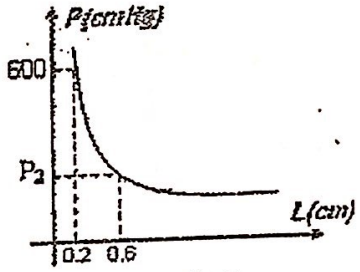


fig.5

$P_1 = \frac{C_1}{L_1}$ // $P_2 = \frac{C_2}{L_2}$

اقسم على بعض

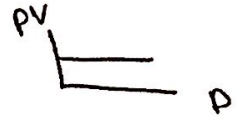
$\frac{P_1}{P_2} = \frac{L_2}{L_1}$

$\frac{600}{P_2} = \frac{0.6}{0.2} \Rightarrow P_2 = 200\ cmHg$

a حل

Q12)Gases laws: The graph that should be obtained if PV is plotted against P is
a) a line parallel to P axis
b) a line passes through origin
c) a line parallel to PV axis
d) none of the above

$PV = nRT + O$



a

EX The pressure of the expressed gas in the following figure is:

الدورة الثانية 2015

ⓐ 1050 mmHg ⓑ 780 mmHg ⓒ 720 mmHg

ⓓ 450 cmHg ⓔ 450 mmHg

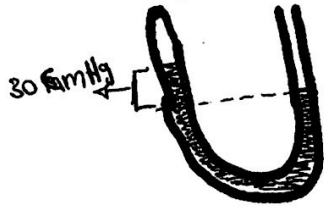
Sol:

$P_{gas} = P_a + h$

$= 750 + 300$

$= 450\ mmHg$

h ملاحظة: h بوحدات mmHg ⟸ ×10 cmHg



$P_a = 750\ mm$

ⓔ الإجابة الصحيحة

EX According to the figure the atmosphere pressure in mmHg is:-

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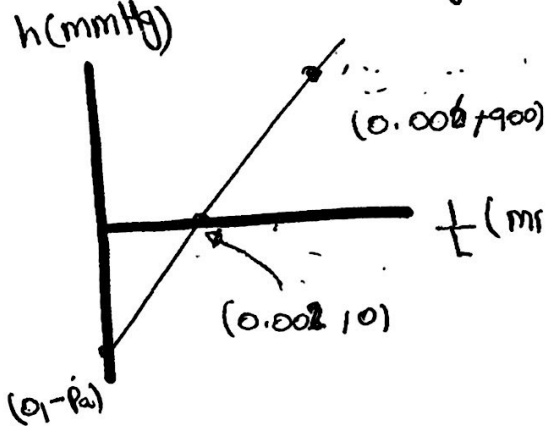
ⓐ 450 ⓑ 600 ⓒ 850

ⓓ 400 ⓔ 550



slope (0.002,0) & (0.006,900) = slope (0.002,0) & (0,-Pa) ⟸ الميل

$$\frac{900-0}{0.006-0.002} = \frac{0-(-P_a)}{0.002-0}$$

$$225000 = \frac{P_a}{0.002}$$

$P_a = 450\ mmHg$

EX In Boyl's Law experiment, Boyl's Law is $PV = constant$ at constant:

الفصل الثاني 2015

ⓐ pressure ⓑ Temprature ⓒ volume ⓓ All of the above

Experiment (11)

Specific heat capacity of metals

Ex 11: specific heat Capacity of metals.

kg $\xrightarrow{*10^3}$ g

ملاحظة

القانون لهذه التجربة :

$$\frac{Q}{\Delta T} = mc$$

Q : ⇒ heat ⇒ وحدتها : Calori / Joul

ΔT : ⇒ Temperature ⇒ C° (الوحدة)

m : ⇒ mass (g) / (kg) الوحدة

C : ⇒ specific heat Capacity (Cal/g.c°) ⇒ الوحدة

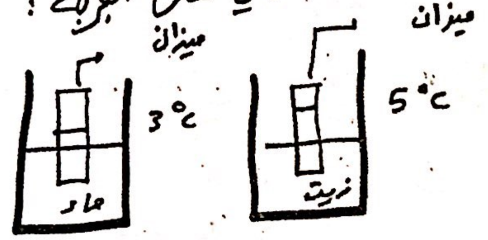
*Remark: 1 calori = 4.18 Joul

C : specific heat Capacity : وهي الطاقة اللازمة لرفع درجة حرارة غرام من المادة درجة سيلسيوس واحدة ..

The quantity of heat required to raise the temperature of one gram of a substance by 1°c

⇒ depend on ⇒ تعتمد على ⇒ type of metal only نوع المادة فقط مهم

*مثال توضيحي لفكرة التجربة :



* هنا وضعنا الوعائين عند نفس درجة الحرارة مثلاً 30°c لمدة ربع ساعة .

نفس الكمية

* الزيت سخن أسرع بالرغم أنه عند نفس درجة حرارة الماء .

* الزيت سخن أسرع ويبرد أسرع بالتالي يحتاج إلى طاقة أقل ⇐ C أقل .

* الماء يبرد أبطأ ويسخن أبطأ بالتالي تحتاج إلى طاقة أكبر ⇐ C أكبر .

C الماء > C الزيت

C : تعتمد دائماً على نوع المادة .

سؤال سنوات

* Ex : If the specific heat capacity of body is small then it :

بما أنه C قليله بالتالي سوف يسخن حرارة أسرع

solution: Loses heat faster and gains heat faster

* $\left(\frac{Q}{\Delta T}\right)$ ⇒ heat capacity ⇒ وحداتها .
- Cal / C°
- J / C°
- Cal / F
- Cal / Kelvin

1 cal = 4.18 J

*حفظ :

1 K = C° + 237

F = 1.8 C° + 32

Scanned by CamScanner

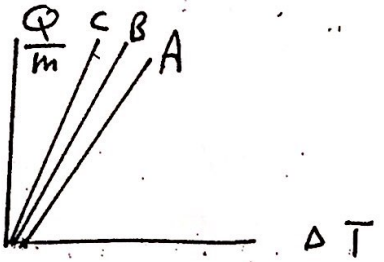
The Unit of the heat Capacity is Cal?? answer ⇒ false (X)

* heat capacity: هي الطاقة اللازمة لرفع درجة حرارة الجسم كامل درجة سيليسيوس واحدة فقط

The heat absorbed by one part of the system is equal to the heat lost by the other part of the system.

*Remark: $\frac{Q}{\Delta T}$; depondon تعتمد ① type of metal ② mass

Ex مثال



* بالبيان slope = C

اكبر ميل ⇐ اكبر C

اقل ميل ⇐ اقل C

① * $\frac{Q}{\Delta T} = mc$

② * $\frac{Q}{m} = \Delta T \, C$

y = x · slope

---

* حتى حل الأسئلة حل هذه الجزئية: لازم تعرف.

قانون حفظ الطاقة

ΔQ Lost = ΔQ agains

ΔQ lost − ΔQ agins = zero

$\sum \Delta Q_{\text{للعادة}} = \text{zero}$

دائماً تكتب هذه المعادلة ⇐

$\sum \Delta Q$ لجميع المواد = zero

$\Delta Q_{\text{للمادة}} = (mc\,\Delta T)_{\text{للمادة}}$ ⇒ دائماً ⇒ $\Delta T = T_f - T_i$

له بعض النظر عن المادة التي فقدت طاقة أو المادة التي كسبت طاقة !!

Ex: a metal of mass 100g lost 150 cal of heat the difference between the final and intial temperature is 15°C the the specific heat capacity of the metal??

solution: $\Delta Q_{فاقدة} = (m c \Delta T)_{فاقدة}$: metal بما أنها طاقة مفقودة من الفلز

$\Rightarrow 150 = 100 * C * 15° \Rightarrow \frac{150}{100*15} = c \Rightarrow c = 0.1$ cal/g

❖ **Specific heat capacity experiment:**

10) A 60 gm piece of a metal is heated to 120 C° and then dropped into a beaker with 30gm of water (C_w = 1 cal/g. C°) at 20C°. If the equilibrium temperature of the system is 31C°, then the specific heat capacity (in cal/g.C°) of metal closes to: (Ignore the mass of beakers).

a) 0.04
b) 0.05
c) 0.08
d) 0.06

11) In this experiment, the heat transfer from the metal to the water until:

a) The specific heat capacity of water becomes equal to the metal.
b) The heat capacity of water become equal to the metal
c) The final temperature of water equals the initial temperature of metal.
d) The final temperature of water equals the final temperature of metal.

note: $\sum \Delta Q = 0$

solution: ① $\sum \Delta Q = zero$

$\Delta Q_{metal} + \Delta Q_{water} = 0$

$(mc\Delta T)_{metal} + (mc\Delta T)_{water} = 0$

$(60 * C * (T_F - T_i))_{met} + (30*1(T_F - T_i)) = 0$

$(60 * c * (31 - 120)) + (30(31-20)) = 0$

$-5340C + 330 = 0$

$\frac{-5340\,C}{-5340} = \frac{-330}{-5340} \Rightarrow C = 0.06$ cal/g.C°

*هذه الطريقة سهلة وبسيطة بس $\Delta T = T_f - T_i$

② d: The final temperature of water equals the final temperature of metal.

Specific Heat Capacity Experiment:

(5) 100g of copper piece is heated to 50°C and dropped in 60g of water at 80°F, the specific heat capacity of copper and water is 0.14, 1 cal/g.°C, respectively. The final equilibrium temperature T_f is (in °C):

(a) 25.9 (b) 13.8 (c) 31.1 (d) 38.3

(6) Depending on the previous question, the heat capacity of copper piece (in cal/ °C) is:

(a) 12 (b) 60 (c) 0.12 (d) 14

(7) In this experiment, you measure the temperature of boiling water because it represents:

(a) The initial temperature of the metal.
(b) The initial temperature of the cup.
(c) The final temperature of the metal.
(d) The temperature of the atmosphere.

Solut: 5) $T_{i\,water} = 80\ F$

$F = 1.8\,C^\circ + 32$

$80 = 1.8\,C^\circ + 32$

$T_{i\,water} = 26.6^\circ C$

* $T_{F\,copper} = T_{F\,water}$

* نرمز بهذه لحالة الاتزان

* $\sum \Delta Q = 0$

$\Rightarrow (\Delta Q)_{copper} + (\Delta Q)_{water} = 0$

$\Rightarrow (mC\Delta T)_{copper} + (mC\Delta T)_{water} = 0$

ملاحظة: دائماً T_F تبقون لجميع المواد الموجودة في النظام متساوية !!

$\Rightarrow (100 * 0.14\,(T_F - 50))_{copper} + (60 * 1 * (T_F - 26.6))_{water} = 0$

$(14(T_F - 50)) + (60(T_F - 26.6)) = 0$

$14T_F - 700 + 60T_F - 1596 = 0$

$74T_F - 2296 = 0$

$74T_F = 2296$

$T_F = 31\,C^\circ$

Ex: Two Blocks of metal are in an isolated system one with a heat Capacity of [2000 J/C°] and an initial temprature of [427°C] and the second with heat Capacity of [500 J/C°] at a temprature of [90°C] throught into thermal Contact, whats the final temperature of the Blocks after thermal equilibrium is reached?

a) 370.6 b) 347.6 c) 539.3 d) ~~359.6~~ 359.6

d) 995.6

$$\left(\frac{\Delta Q}{\Delta T}\right)_{\text{first metal}} = 2000$$

$$\frac{\Delta Q}{T_F - 427} = 2000 \quad -(1)$$

ΔQ نوعضن

Thermal equilibrium

$$\left(\frac{\Delta Q}{\Delta T}\right)_{\text{second metal}} = 500$$

$$\frac{\Delta Q}{T_F - 90} = 500 \quad \cdots (2)$$

$$\Rightarrow \frac{\frac{\Delta Q}{T_F - 427}}{\frac{\Delta Q}{(T_F - 90)}} = \frac{2000}{5000} \Leftarrow$$

نقسم المعادلتين

$$\therefore T_F - 90 = 4 \Rightarrow T_F - 90 = 4T_F - 1708$$

EX 432 J of energy is required to raise the temprature of aluminum from 59°F to 35°C, calculate the mass (in g) of aluminum: [Specific heat capacity of aluminum is 0.90 J/g.C°.

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(a) 24 (b) 33 (c) 54 (d) 144 (e) 233

$T_i = 59°F \Rightarrow \frac{59-32}{1.8} = T_c° \Rightarrow T_i = 15°C$

$T_f = 35°C$

$\Delta Q_{AL} = (m c \Delta T)_{AL}$

$432 = m * 0.90 (T_f - T_i)$

$432 = m * 0.90 (35 - 15)$

$m = 24\ g$

⟸ الحل

EX two metal samples, X and Z of the same mass and initially at 25°C, are heated so that each receives the same amount of thermal energy, which metal will have the highest Final temprature: [Specific heat capacity $C_X = 0.351\ J/g.C°$, $C_Z = 0.8951\ J/g.C°$

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(a) metal X (b) metal Y

(c) both reach the same temperature (d) none of above since we don't know the mass of metals

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EX A combination of 0.125 kg of water at 20C°, 1.4 kg of Aluminum at 26C° and 0.1 kg of copper at 100C° is mixed in an insulated container and allowed to come to thermal equilibrium. Ignore any energy transfer to or from the container. what's the final temprature of the mixture?

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$C_{water} = 4186\ J/Kg.C°$ / $C_{AL} = 900\ J/Kg.C°$ / $C_{copper} = 387\ J/Kg.$

(a) 21.1 (b) 700 (c) 22.1 (d) 23.6 (e) 25.7

⟸ الحل

$\sum \Delta Q = 0$

$\Delta Q_{water} + \Delta Q_{copper} + \Delta Q_{AL} = 0$

$(mc\Delta T)_{water} + (mc\Delta T)_{copper} + (mc\Delta T)_{AL} = 0$

$0.125 * 4186 * (T_f - 20) + (0.1 * 387 * (T_f - 100) + (0.4 * 900 * (T_f - 26)) = 0$

$523.25\ T_f - 10465 + 38.7\ T_f - 3870 + 360\ T_f - 9360 = 0$

$* 921.95\ T_f - 23695 = 0$

$T_f = 25.7\ C°$

Specific Heat:

0- what is the main source of error in this experiment? Due to this error will the value of specific heat obtained be greater or smaller than the expected value?

جواب السؤال

10- lost of heat in the surrounding / it will be smaller than the expected valu-

ضياع الحرارة في المحيط
وهو Random error

دائماً ضياع الطاقة يؤدي الى تقليل الناتج

Q9) Specific heat: In this experiment you measure the temperature of the boiling water because it represents
a) the final temperature of the metal b) the initial temperature of the cup
c) the initial temperature of the metal d) the temperature of the atmosphere

الجواب

Q16) The unit of heat is
a) C b) K c) J d) W

Joul او calori

Q17) If the specific heat capacity of a body is small it
a) loses heat faster b) gains heat slower
c) has a small density d) none of the above

20) $\frac{Q}{\Delta T} = mc$

1] $\frac{Q}{\Delta T} = m_1 c_1 = 50 * 0.42 = 21$

2] $\frac{Q}{\Delta T} = m_2 c_2 = 50 * 0.36 = 18$

21 > 18 ∴ b ξ

9- Specific Heat:

A) A 100 gm copper block with specific heat 0.1 cal/gram °C at a temperature (T= 95°C) calorimeter is immersed a colorimeter 100 grams of water initially at 20 °C. If the final temperature is 25 °C.T heat capacity of the calorimeter is -----

$\sum \Delta Q = 0$

$\Delta Q_{copper} + \Delta Q_{calorimeter} + \Delta Q_{water} = 0$

$(mc\Delta T) + (mc\Delta T) + (mc\Delta T) = 0$

$(100 * 0.1 * (25-95)) + (100 * C * (25-20)) + (100 * 1 (25-20)) = 0$

$-700 + 500C + 500 = 0$

$500C = +200$

$C = +0.4 \ cal/g.C°$

B) To minimize the heat loss to the surroundings, one should:

(a) Insulate the calorimeter.

b) Increase the initial temperature of *the* co over block.

c) Decrease the mass of the water in the calorimeter

d) Increase the mass of the water in the calorimeter

12- Specific Heat Capacity of Metals:

- The unit of Specific heat capacity is cal/g.C° // J/g.C°
- The major error contributing to this experiment is Random error (Lost heat to surroundings)

(1)

6) $\frac{Q}{\Delta T} = mC \Rightarrow 100 * 0.14 = 14\ Cal/C^\circ$

---

* Two pieces of metal of equal masses *(50g)* are putting in *100g* water of temperature *20°C* and the specific heat capacity of water is *1cal/g°C*. The specific heat capacity and initial temperature of the metals (m_1 and m_2) are *0.42cal/g°C*, *55°C* and *0.36cal/g°C*, *70°C*, respectively. Depending on this information answer questions *(18 to 20)*.

18. The equilibrium temperature *(T_f)* of the system is: ← متساوية الجميع اكماد

(a) *28.2°C*
(c) *31.8°C*
(b) *47.3°C*
(d) *73.6°C*

19. The heat gained by the metals (in *cal.*) is:

(a) *1155*
(c) *1260*
(b) *1180*
(d) *1320*

20. The heat capacity of the two metals m_1 and m_2, respectively, in (*cal./°C*) is:

(a) *18, 21*
(c) 8.4×10^{-3}, 7.2×10^{-3}
(b) *21, 18*
(d) 7.2×10^{-3}, 8.4×10^{-3}

18: $\sum \Delta Q_{\text{الكماد}} = 0$

$\Delta Q_1 + \Delta Q_2 + \Delta Q_{water} = 0$

$(m\ C\ \Delta T)_{m1} + (mC\Delta T)_{m2} + (mC\Delta T)_{water} = 0$

$(50 * 0.42 * (T_F - 55))_{m1} + (50 * 0.36 * (T_F - 70))_{m2} + (100(T_F - 20)) = 0$

$(21(T_F - 55)) + (18(T_F - 70)) + (100\,T_F - 2000) = 0$

$21\,T_F - 1155 + 18\,T_F - 1260 + 100\,T_F - 2000 = 0$

$139\,T_F - 4415 = 0$

$\frac{139\,T_F}{139} = \frac{4415}{139} \Rightarrow 31.76 \Rightarrow 31.8^\circ C$

water · الحرارة المفقودة من ال = metals من ال الحرارة المكتسبة =

$m_w C_w \Delta T_w$

$= 100 * 1 * (31.8 - 20)$

$31.8 = 11$