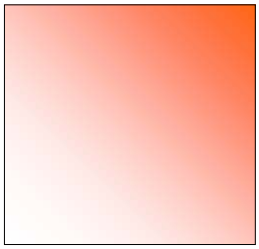
University of Jordan
Faculty of Engineering and Technology
Chemical Engineering Department

ChE 905322 – Chemical Engineering Thermodynamics I

الاسم	:
الرقم الجامعي	:
المادة	: ديناميكا حرارية ١ (٩٠٥٣٢٢)
الامتحان	: النهائي
التاريخ	:٢٠٠٤\١\١٩
مدرس المادة	: د. علي المطر



السؤال	١	٢	٣	٤	٥	٦	٧	٨	٩	١٠	١١	١٢
العلامة الكاملة	٣٠	١٠	١٠	١٠	١٠	٣٠						
العلامة												

وقع على القسَم التالي المتعلق بالغش الأكاديمي:

اقسم بالله أنني لم اغش في هذا الامتحان ولم أساعد أي شخص على الغش سواءً لمنفعتي الشخصية أو لمنفعة الآخرين، وعلى هذا أوقع.

التوقيع:

Question 1 (30 points)

Select the most correct answer and circle it in the provided answers sheet. More than one answer may be correct, make your choices carefully and wisely.

1. Which of the following substances is not a common refrigerant?

a) NH_3 b) HFC-134a c) CH_3Cl d) HCFCD-123

2. Why were the CFC's abandoned as refrigerants?

a) Toxicity b) Not safe in handling c) Caused ozone layer depletion d) Very costly

3. How is the efficiency in liquefaction processes defined?

a) Gas produced per unit work supplied b) liquefied gas produced per unit work in the compressor c) Liquefied gas to feed gas ratio d) Liquefied gas produced per cooling load

4. The Linde process differs from simple liquefaction process by:

a) Recycling the gas stream from the flash drum b) Recycling the liquid stream from the flash drum c) Uses a throttle valve instead of a turbine d) Uses a turbine instead of a throttling valve.

5. The Joule-Thompson expansion (throttling process), occurs at a constant

a) Entropy b) Volume c) Enthalpy d) Pressure

6. Which one of the following is not fossil fuel?

a) Petroleum b) Natural gas c) Fuel cells d) Coal

7. Which ideal cycle below is used to describe a "real" steam power plant?

a) Brayton b) Otto c) Rankine d) Carnot

8. Which ideal cycle is used to describe the gas-turbine engine

a) Brayton b) Otto c) Rankine d) Carnot

9. Otto and Diesel engines are used in

a) Internal combustion b) Spark ignition c) Compression ignition d) Rockets

10. The main difference between the Otto and Diesel engines occurs in which step?

a) Heat removing b) Heat addition c) Compression d) Expansion

11. The main difference between a turbo-jet engine and a rocket is

a) Both rockets and turbo-jet engine carry their oxidizing agent. b) Turbo-jet engine carries the oxidizing agent, rockets do not. c) Turbo-jet engine do no carry the oxidizing agent, rockets do. d) The oxidizing agent is not compressed in turbo-jet, in rockets it is compressed.

12. Which one of the following is considered a good oxidizing agent for solid-fuelled rockets?

a) Chlorates b) Chlorides c) Perchlorates d) hypochlorates

13. What is the main mechanism of generating power in the turbo-gas engines?

a) Expansion valves b) Turbines c) Piston-cylinder d) Direct electricity

14. What is the main mechanism of generating power in internal combustion engines?

a) Expansion valves b) Turbines c) Piston-cylinder d) Direct electricity

15. What is the range of typical compression ratios used in the Diesel engine?

a) 4-8 b) 7-10 c) 12-22 d) 18-30

16. What is the range of typical compression ratios used in the Otto gasoline engine?

a) 4-8 b) 7-10 c) 12-22 d) 18-30

17. Mach numbers higher than one are called

a) Sub-sonic b) Sonic c) Super-sonic d) Ultra-sonic

18. Throttling processes can be achieved by which mean(s)?

a) Turbines b) Porous plugs c) Adjustable valves d) B and C

19. What is the range of typical efficiencies for turbines and compressors?

a) 0.4-0.5 b) 0.5-0.6 c) 0.6-0.7 d) 0.7-0.8

20. To move large flow rates of gases at low pressure ratios, the device used to achieve this is called

a) Pump b) Compressor c) Blower d) Turbine

21. The inlet and outlet streams of a compressor are called

a) Suction & discharge b) Discharge & suction c) Suction & diffuse d) Diffuse & suction

22. The coefficient of performance (COP) for a refrigerator (R) and heat pump (H) are related by

a) $COP_R = COP_H + 1$ b) $COP_H = COP_R + 1$ c) $COP_H = COP_R$ d) $COP_R > COP_H$

23. What is the critical compressibility factor predicted by the van der Waal's equation of state?

a) 0.29 b) 0.30 c) 0.31 d) 0.375

24. In general the value of Pitzer's acentric factor is

a) Negative. b) Positive. c) 0. d) Infinity.

25. To use the Peng-Robinson EOS in a corresponding states theory, it would yield a theory with

a) One parameter b) Two parameters c) Three parameters d) Does not apply.

26. To estimate the saturated liquid molar volume, the correlation recommended usually is

a) Pitzer b) Rackett c) Any equation of state d) Virial equation

27. The ratio of specific heats for NH_3 would approximately be:

a) 1.67 b) 1.4 c) 1.3 d) 1.0

28. The transition from solid to gas is called

a) Vaporization b) Fusion c) Melting d) Sublimation

29. A vapor at a pressure below its saturation pressure is called

a) Subcooled b) Superheated c) Critical d) Supercritical

30. The energy flow due to magnetic or an electric field is classified as a type of

a) Heat transfer b) Shaft work c) Work d) Electromagnetic energy.

Question 2 (10 points)

An inventor claims to have developed a refrigerator that maintains the refrigerated space at 2°C while operating in a room where the temperature is 25°C and has a COP of 13.5. Is there any truth to his claim?

Question 3 (10 points)

Steam at 700 bar and 600°C enters a throttling valve where it is expanded to 10 bars.

1. What is the phase of the outlet stream?
2. What is the rate of entropy generation?

Question 4 (10 points)

Air is heated in a heat exchanger by hot water. The water enters the heat exchanger at 45°C and experiences a 20°C drop in its temperature. As the air passes through the exchanger, its temperature is increased by 25°C. Determine the ratio of mass flow rate of the air to the mass flow rate of the water.

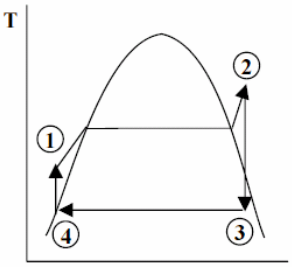
Question 5 (10 points)

Determine the enthalpy of combustion of gaseous normal octane ($n\text{-}C_8H1_8$) at the standard reference state. Assume water in the products is in the liquid form.

Question 6 (30 points)

Steam enters the turbine of a power plant operating on the Rankine cycle at 3,300 kPa and exhausts at 50 kPa.

1. Determine the thermal efficiency of the cycle and the quality of the exhaust steam from the turbine for turbine-inlet stream temperatures 500°C
2. If the turbine had an efficiency of 0.80, determine its impact on the thermal efficiency of the process.



Student Name:

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❶❸	○	○	○	○
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❶❼	○	○	○	○
❶❽	○	○	○	○
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Fill the circles completely.
Don't fill more than one circle for each question. If there are more than one circles filled, you will get a zero for that question.
No answers on the questions sheet will be accepted.
Use a black/blue pen not a pencil.