JEE MAins PYQs Thermodynamics (Physics Master Academy)

QUESTIONS

SECTIONS

1. Section A - 25 Questions

Section 1 : Section A - 25 Questions

SECTION INSTRUCTIONS

This section contains 25 MCQs. +4 for every correct answer, -1 for very incorrect answer.

1   In thermodynamics, heat and work are

○   Point functions

○   Extensive thermodynamics state variables

○   path functions

○   Intensive thermodynamics state variables

Correct: +4 · Incorrect: -1

2   200g of water is heated from 40°C to 60°C. Ignoring the slight expansion of water, the change in its internal energy is close to (Given specikc heat fo water = 4184 J/kgK)

○   167.4 kJ

○   8.4kJ

○   4.2kJ

○   16.7kJ

Correct: +4 · Incorrect: -1

3   A system goes from A to B via two processes I and II as shown in kgure. If ΔU_1 and ΔU_2 are the changes in internal energies in the processes I and II respectively then
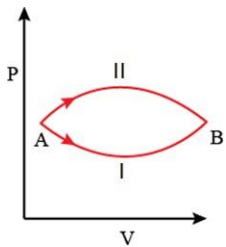
○ relation between ΔU_1 and ΔU_2 cannot be determined

○ $U_1 = \Delta U_2$

○ $U_1 < \Delta U_2$

○ $U_1 > \Delta U_2$

<div align="right">Correct: +4 · Incorrect: -1</div>

4 Which of the following is incorrect regarding the krst law of thermodynamics?

☐ it is re-statement to the principle of conservation of energy

☐ it is not applicable to any cyclic process

☐ it does not introduces the concept of the entropy

☐ it introduces the concept of internal energy

<div align="right">Correct: +4 · Incorrect: -1</div>

5 An ideal gas in a cylinder is separated by a piston in such a way that the entropy of one part is S_1 and that of the other part is S_2. Given that $S_1 > S_2$. If the piston is removed then the total entropy of the system will be

○ $S_1 - S_2$

○ $S_1 \times S_2$

○ S_1 / S_2

○ $S_1 + S_2$

<div align="right">Correct: +4 · Incorrect: -1</div>

6 For an adiabatic expansion of an ideal gas, the fractional change in its pressure is equal to (where γ is the ratio of specikc heat)
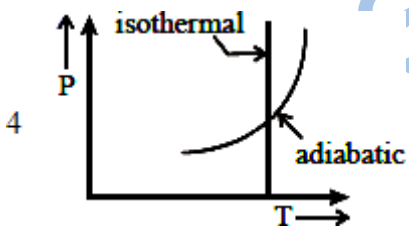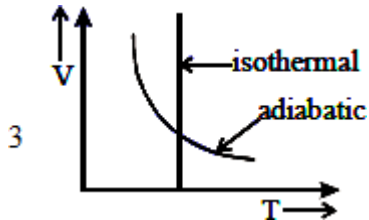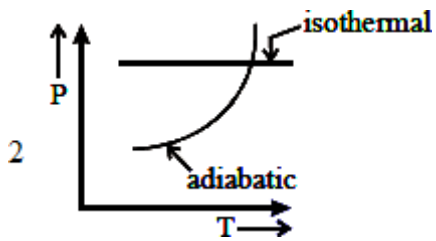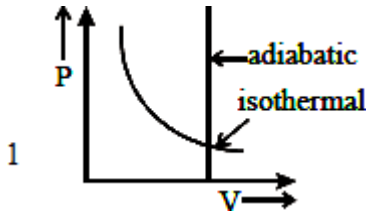
○ $-\gamma \dfrac{V}{dV}$

○ $-\gamma \dfrac{dV}{V}$

○ $\dfrac{-1}{\gamma}\dfrac{dV}{V}$

○ $\dfrac{dV}{V}$

7 Which one is the correct option for the two different thermodynamics processes?


○ (3) and (4)

○ (1)Only

○ (3) and (1)

○ (2) and (3)

8 A balloon is klled with helium (32°C and 1.7atm) bursts. Immediately afterwards the expansion of helium can be considered as

○ irreversible isothermal

○ irreversible adiabatic

○ reversible adiabatic

○ reversible isothermal

9 A sample of an ideal gas is taken through the cyclic process abca as shown in kgure. The change in the internal energy of the gas along the path ca is – 180J. The gas absorbs 250J of heat along the path ab and 60J along the path bc. The work done by the gas along the path abc is
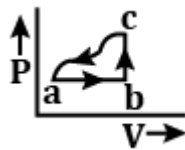

○ 120J

○ 130J

○ 100J

○ 140J

10 A cylinder with kxed capacity of 67.2 lit contains helium gas at STP. The amount of heat needed to raise the temperature of the gas by 20°C is (given that R = 8.31J mol^{-1}K^{-1}]

○ 350J

○ 374J

○ 748J

○ 700J

11 Following kgure shows two processes A and B of a gas. If ΔQ_A and ΔQ_B are the amount of heat absorbed by the system in two cases, and ΔU_A and ΔU_B are changes in internal energies, respectively, then
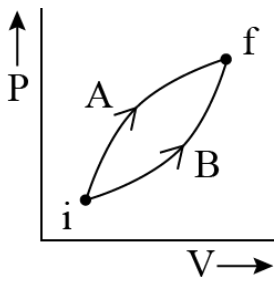
○ $\Delta Q_A < \Delta Q_B, \Delta U_A < \Delta U_B$

○ $\Delta Q_A > \Delta Q_B, \Delta U_A > \Delta U_B$

○ $\Delta Q_A > \Delta Q_B, \Delta U_A = \Delta U_B$

○ $\Delta Q_A = \Delta Q_B, \Delta U_A = \Delta U_B$

<div align="right">Correct: +4 · Incorrect: -1</div>

12   A thermally insulated vessel contains 150g of water at 0°C. Then the air from the vessel is pumped out adiabatically. A fraction of water turns into ice and the rest evaporates at 0°C itself. The mass of evaporated water will be close to (Latent heat of vaporization of water = 2.10×10^6 J kg^{-1} and latent heat of Fusion of water = 3.36×10^5 J Jkg^{-1})

○ 150g

○ 20g

○ 130g

○ 35g

<div align="right">Correct: +4 · Incorrect: -1</div>

13   The given diagram shows four processes i.e. isochoric, isobaric, isothermal and adiabatic. The correct assignment of the processes, in the same order is given by
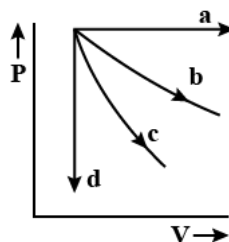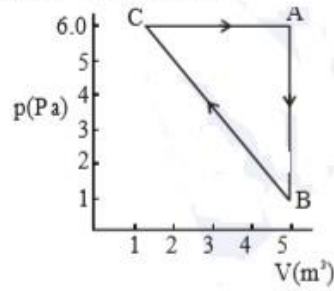

○ a d b c

○ d a c b

○ a d c b

○ d a b c

14 For the give cyclic process CAB as shown for gas, the work done is

○ 30J

○ 10J

○ 1J

○ 5J

15 Half mode of an ideal monoatomic gas is heated at constant pressure of 1atm from 20°C to 90°C. Work done by gas is close to (Gas constant R = 8.31J/mol-K)

○ 581J

○ 291J

○ 146J

○ 73J

16 One mole of an ideal monoatomic gas is compressed isothermally in a rigd vessel to double its pressure at room temperature 27°C. The work done on the gas will be

○ 300R ln 6

○ 300R

○ 300R ln 7

○ 300R ln 2

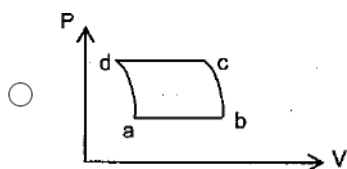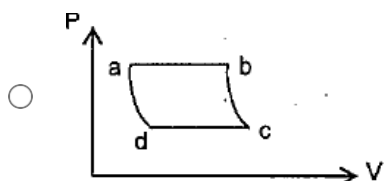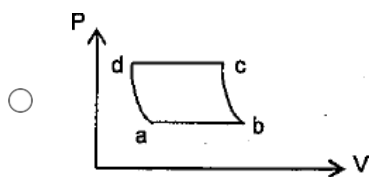**17** An ideal gas through a reversible cycle a → b → c → d has the V-T diagram shown below. Process d → a and b → c are adiabatic
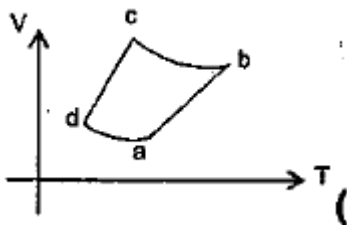
The corresponding P-V diagram for the process is (all kgures are schematic and not drawn to scale)

○

○

○

○
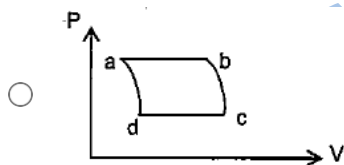
18 The question has Statement 1 and Statement 2. Of the four choices given after the statements, choose the one that best describes the two statements.
Statement 1: In an adiabatic process, change in internal energy of a gas is equal to work done by the gas in the process.
Statement 2: The temperature of a gas remains constant in an adiabatic process.

○ Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1

○ Statement 1 is true, Statement 2 is false

○ Statement 1 is false, Statement 2 is true

○ Statement 1 is false, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1

19 A heat engine operates between a cold reservoir at temperature T_2 = 400JK and a hot reservoir at temperature T_1. It makes 300J of heat from the hot reservoir and delivers 240 J of heat to the cold reservoir in a cycle. The minimum temperature of the hot reservoir has to be_K.

○ 250

○ 300

○ 500

○ 550

20 A heat engine has n efkciency of 1/6. When the temperature of sink is reduced by 62°C, its efkciency get doubled. The temperature of the source is

○ 124°C

○ 37°C

○ 62°C

○ 99°C

21 A Carnot's engine working between 400K and 800K has a work output of 1200J per cycle. The amount of heat energy supplied to the engine from the source in each cycle is

○ 1800J

○ 3200J

○ 1600J

○ 2400J

22 Three Carnot engines operate in series between a heat source at a temperature T_1 and a heat sin at temperature T_4 (see kgure). There are two other reservoirs at temperatures T_2 and T_3 as shown with $T_1 > T_2 > T_3 > T(4)$. The three engines are equally efkcient if

- ○ $T_2 = ¿$
- ○ $T_2 = ¿$
- ○ $T_2 = ¿$
- ○ $T_2 = ¿$

<div align="right">Correct: +4 · Incorrect: -1</div>

23 A Carnot's engine works as a refrigerator between 2150K and 300K. It receives 500 cal heat from the reservoir at the lower temperature. The amount of work done in each cycle to operate the refrigerator is

- ○ 420J
- ○ 2100J
- ○ 772J
- ○ 2520J

<div align="right">Correct: +4 · Incorrect: -1</div>

24 A solid boy of constant heat capacity 1J/°C is being heated by keeping it in contact with reservoirs n two ways
(i) Sequentially keeping in contact with 2 reservoirs such that each reservoir supplies same amount of heat
(ii) Sequentially keeping in contact with 8 reservoirs such that each reservoir supplies same amount of heat
In both cases body is brought from initial temperature 100°C to knal temperature 200°C. Entropy change of the body in the two cases respectively is

- ○ ln2, 2ln2
- ○ 2ln2, 8ln2
- ○ ln2, 4ln2
- ○ ln2, ln2

25   The door of working refrigerator is left open in a well insulated room. The temperature of air in the room will

○ decrease

○ increase in winters and decrease in summers

○ remain the same

○ increase

ANSWERS

SECTIONS

1. Section A - 25 Questions

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1 path functions

2 16.7kJ

3 $U_1 = \Delta U_2$

4 it is not applicable to any cyclic process   it does not introduces the concept of the entropy

5 $S_1 + S_2$

6 $-\gamma \dfrac{dV}{V}$

7 (3) and (4)

8 irreversible adiabatic

9 130J

10 748J

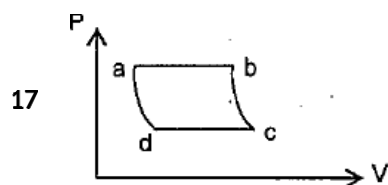**11** $\Delta Q_A > \Delta Q_B, \Delta U_A = \Delta U_B$

12 20g

13 d a b c

14 10J

15 291J

16 300R ln 2

17

18 Statement 1 is true, Statement 2 is false

19 500

20 99°C

21 2400J

22 $T_2 = ¿$

23 420J

24 ln2, ln2

25 increase

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