JEE MAIN : CHAPTER WISE TEST PAPER-12

SUBJECT :- PHYSICS **DATE.....**
CLASS :- 11th **NAME.....**
CHAPTER :- KTG & THERMODYNAMICS **SECTION.....**

(SECTION-A)

1. The ratio of work done by the gas to the change in internal energy of the gas is
(A) 1 (B) –1 (C) ∞ (D) 0

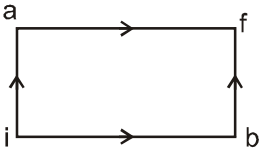
2. Which statement is incorrect ?
(A) All reversible cycles have same efficiency
(B) Reversible cycle has more efficiency than an irreversible one
(C) Carnot cycle is a reversible one
(D) Carnot cycle has the maximum efficiency in all cycles

3. If E is translation kinetic energy per unit volume of an ideal gas than pressure of the gas is given by relation:
(A) $P = \frac{3}{2}E$ (B) $P = 3E$
(C) $P = \frac{2E}{3}$ (D) $P = \frac{E}{3}$

4. 4 moles of H_2 at 500 K is kept in an adiabatic rigid container. After some time it was found that 1 mole of the gas dissociated into H atoms . The dissociation energy per mole of H_2 gas is 2000 cal,Let the new temperature of the gas be 100T. The integral value of T is : (Use R= 2cal/mole-K)
(A) 3 (B) 4 (C) 5 (D) 6

5. 100g of water is heated from 30ºC to 50ºC ignoring the slight expansion of the water, the change in its internal energy is (specific heat of water is 4184 J/Kg/K) :
(A) 4.2 kJ (B) 8.4 kJ
(C) 84 kJ (D) 2.1 kJ

6. When a system is taken from state i to state f along the path iaf, it is found that Q = 50 cal and W = 20 cal. Along the path ibf Q = 36 cal. W along the path ibf is :



(A) 6 cal (B) 16 cal
(C) 66 cal (D) 14 cal

7. If C_p and C_V denote the specific heats of nitrogen per unit mass at constant pressure and constant volume respectively, then
(A) $C_p - C_v = R / 28$
(B) $C_p - C_v = R / 14$
(C) $C_p - C_v = R$
(D) $C_p - C_v = 28R$

8. Which of the following parameters does not characterise the thermodynamic state of matter?
(A) Temperature (B) Pressure
(C) Work (D) Volume

9. In an adiabatic process on a gas with $\gamma = 1.4$, the pressure is increased by 0.5%. The volume decreases by about
(A) 0.36% (B) 0.5%
(C) 0.7& (D) 1%

10. At what temperature volume of an ideal gas at 0ºC becomes triple ?
(A) 546ºC (B) 182ºC
(C) 819ºC (D) 646ºC

11. An ideal gas is filled in a closed rigid and thermally insulated container. A coil of 100Ω resistor carrying current 1A for 5 minutes supplies heat to the gas. The change in internal energy of the gas is
(A) 10 KJ (B) 20 KJ
(C) 30 KJ (D) 0 KJ

12. Which of the following is correct for the molecules of a gas in thermal equilibrium ?
(A) All have the same speed
(B) All have different speeds which remain constant
(C) They have a certain constant average speed
(D) They do not collide with one another.

13. A diatomic ideal gas is used in a Carnot engine as the working substance. If during the adiabatic expansion part of the cycle the volume of the gas increases from V to 32 V, the efficiency of the engine is :
(A) 0.5 (B) 0.75 (C) 0.99 (D) 0.25

14. When an ideal diatomic gas is heated at constant pressure , the fraction of the heat energy supplied which increases the internal energy of the gas is .

(A) $\frac{2}{5}$ (B) $\frac{3}{5}$

(C) $\frac{3}{7}$ (D) $\frac{5}{7}$

15. The efficiency of Carnot engine is 50% and temperature of sink is 500 K. If the temperature of source is kept constant and its efficiency is to be raised to 60%; then the required temperature of the sink will be :

(A) 600 K (B) 500 K
(C) 400 K (D) 100 K

16. A mass of diatomic gas (γ = 1.4) at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rise from 27ºC to 927ºC. The pressure of the gas is final state is :

(A) 28 atm (B) 68.7atm
(C) 256 atm (D) 8 atm

17. At what temperature is the rms velocity of a hydrogen molecule equal to that of an oxygen molecule at 47º C ?

(A) 80 K (B) –73 K (C) 3 K (D) 20 K

18. The ratio of the initial adiabatic bulk modulus of the gas to the final value of adiabatic bulk modulus of the gas is :

(A) 32 (B) 1 (C) 1/32 (D) 4

19. 5.6 liter of helium gas at STP is adiabatically compressed to 0.7 liter. Taking the initial temperature to be T_1, the work done in the process is :

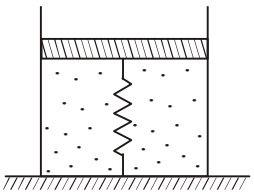
(A) $\frac{9}{8}RT_1$ (B) $\frac{3}{2}RT_1$ (C) $\frac{15}{8}RT_1$ (D) $\frac{9}{2}RT_1$

20. A mixture of 2 moles of helium gas (atomic mass = 4 amu), and 1 mole of argon gas (atomic mass = 40 amu) is kept at 300 K in a container. The ratio of the rms speeds $\left(\frac{v_{rms}(\text{helium})}{v_{rms}(\text{argon})}\right)$ is :

(A) 0.32 (B) 0.45 (C) 2.24 (D) 3.16

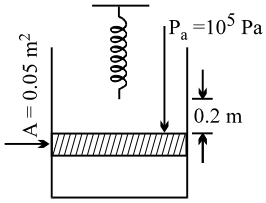
(SECTION-B)

21. A gas is confined in the cylinder under a light piston which is connected to the bottom of the cylinder with a weightless spring as shown in figure, under pressure p = 0.1 MPa and temperature T = 27° C. The initial pressure of the gas is equal to the external atmospheric pressure. To what temperature (in °C) should we heat the gas to increase its volume to n = 1.2 times? If the gas under the piston is fully pumped out, the piston will reach the bottom of the vessel compressing the spring completely without touching the bottom.



22. A Carnot engine works between 600 K and 300 K. In each cycle of operations, the engine draws 1000 joule of energy from the source at 600 K. Then the useful work done by the engine is -

23. A cylinder fitted with a spring loaded piston shown in figure contains 0.01m^3 gas at a pressure of 10^5 Pa. The cross-sectional area of the piston is 0.05 m^2. Initially the spring does not touch the piston but atmospheric pressure of 10^5 Pa acts on the piston. The gas is slowly heated till the volume is increased to three times the original value. If the force constant of the spring is 25 kN / m, calculate the work done by the gas. Draw P-V graph of the process.

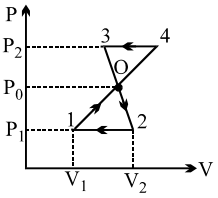


24. A gas having molar mass 25 g is enclosed in a vessel at temperature 300 K. Four of its molecules have speeds 100, 100, 300, 500 m/ s. Find the root mean square speed of these four molecules.

25. The average translational kinetic energy of a molecule in a gas becomes equal to 1 eV at a temperature _____ .

26. In a glass tube filled with a gas and closed by a mercury column of length 8 cm, if you hold the tube such that its open end is up, the length of the gas column is 4cm, but if you hold the tube with its open end down, the length of the gas column is 5 cm. What is the atmospheric pressure (in cm) of mercury column?

27. Determine the work W done by an ideal gas during a closed cycle 1→4→3→2→1shown in the Figure if $p_1 = 10^5$Pa, $p_0 = 3 \times 10^5$Pa, $p_2 = 4 \times 10^5$Pa, $V_2 - V_1 = 10l$, and segments 4–3 and 2–1 of the cycle are parallel to the V–axis.



28. Horizontal cylindrical vessel is divided into two parts with a thin metal piston. One part of the vessel contains oxygen of mass m, the other the hydrogen of mass $\frac{m}{4}$. What is the equilibrium position of the piston (write the length (in cm) of the part with oxygen in it), if the length of the vessel l = 10 cm?

29. Figure-1 shows a length of capillary tubing in which a column of air is trapped by a mercury column of length 100 mm. The length of the air column is 400 mm. The bottom of the tubing is sealed and the top is open to the atmosphere.

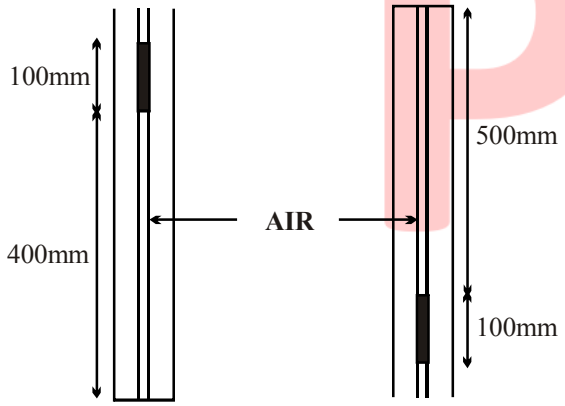


Figure-1 Figure-2

The tubing is now inverted, figure-2, and the air column is seen to increase in length to 500 mm. Use this observation to calculate a value for atmospheric pressure, expressed in $\frac{\text{mm of mercury}}{100}$.

30. An ideal gas is enclosed in a container as shown in figure. The spring constant is 100 N/m, the area of the piston is 1 cm^2 and the length of the gas column is 100 cm. The compression of the spring is 10 cm. There is no friction between the walls and the piston. The whole system is heated to make the temperature 2.4 times the original temperature. Find the distance moved by the piston (in cm) Take atmospheric pressure = 10^5 Pa.