Additional Problems For Self Practice (APSP)

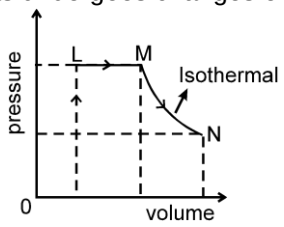
PART- I : PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

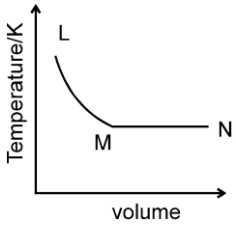
Important Instructions :

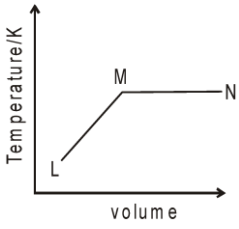
1. The test is of **1 hour** duration and max. marks 120.
2. The test consists **30** questions, **4 marks** each.
3. Only one choice is correct **1 mark** will be deducted for incorrect response. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
4. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 3 above.

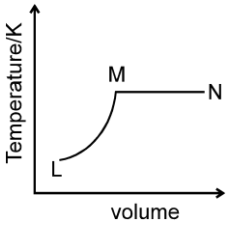
1. A fixed mass of ideal gas undergoes changes of pressure and volume starting at L, as shown in Figure.

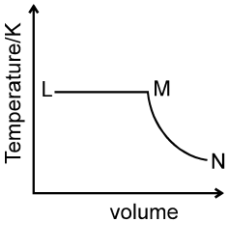


Which of the following is correct :

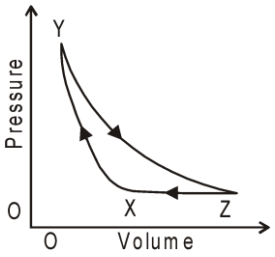
(1) 

(2) 

(3) 

(4) 

2. A fixed mass of an ideal gas undergoes the chage represented by XYZX below (Fig.). Which one of the following sets could describe these of changes ?



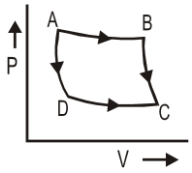
	XY	YZ	ZX
(1)	isothermal expansion	adiabatic comperssion	comperssion at constant pressure
(2)	adiabatic expansion	isothermal comperssion	pressure reduction constant volume
(3)	isothermal comperssion	adiabatic expansion	comperssion at constant pressure
(4)	adiabatic comperssion	isothermal expansion	comperssion at constant pressure

4. Find the amount of work done to increase the temperature of one mole of ideal gas by 30ºC. if it is expanding under the condition $V \propto T^{2/3}$ (R = 8.31 J/mol - K) :
(1) 16.62 J (2) 166.2 J (3) 1662 J (4) 1.662 J

5. $V = k\left(\frac{P}{T}\right)^{0.33}$ where k is constant. It is a,
(1) isothermal process (2) adiabatic process (3) isochoric process (4) isobaric process

6. The molar heat capacity at constant volume of oxygen gas at STP is nearly 2.5 R. As the temperature is increased, it gradually increases and approaches 3.5 R. The most appropriate reason for this behaviour is that at high temperatures
(1) oxygen does not behave as an ideal gas (2) oxygen molecules dissociate in atoms
(3) the molecules collides more frequently (4) molecular vibration gradually become effective

7. If AB and CD are isothermals and AD and BC are adiabatics (see fig.) then the temperatures of
(1) B and C are same (2) A and C are same
(3) B and D are same (4) Temperature of A is more than that of D



8. An ideal gas at 27°C is compressed adiabatically to $\frac{8}{27}$ of its original volume. The rise in temperature is $\left(\gamma = \frac{5}{3}\right)$.

[AIPMT_1999]

(1) 475°C (2) 402°C (3) 275°C (4) 375°C

9. The degrees of freedom a molecule of a triatomic gas are :
(1) 2 (2) 4 (3) 6 (4) 8

10. A gas is formed of molecules each molecule possessing f degrees of freedom, then the value of $\gamma = \frac{C_P}{C_V}$ is equal to :
(1) $\frac{2}{f}$ (2) $1+\frac{2}{f}$ (3) $1+\frac{f}{2}$ (4) $f+\frac{1}{2}$

11. The gases carbon-monoxide (CO) and nitrogen at the same temperature have kinetic energies E_1 and E_2 respectively. Then :
(1) $E_1 = E_2$ (2) $E_1 > E_2$
(3) $E_1 < E_2$ (4) E_1 and E_2 cannot be compared

12. 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 :
(1) 600 K (2) 500 K (3) 400 K (4) 100 K

13. An ideal gas heat engine operates in a Carnot cycle between 227ºC and 127ºC. It absorbs 6 kcal at the higher temperature. The amount of heat (in kcal) converted into work is equal to :
(1) 1.6 (2) 1.2 (3) 4.8 (4) 3.5

14. One mole of an ideal gas at an initial temperature of T K does 6R joules of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is 5/3, the final temperature of gas will be :
(1) (T + 2.4) K (2) (T – 2.4) K (3) (T + 4) K (4) (T – 4) K

15. The equation of state for 5g of oxygen at a pressure P and temperature T, when occupying a volume V, will be :
(1) PV = (5/32) RT (2) PV = 5RT
(3) PV = (5/2) RT (4) PV = (5/16) RT

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 :
(1) 28 atm (2) 68.7atm (3) 256 atm (4) 8 atm

17. The kinetic energy of one mole gas at 300 K temperature, is E. At 400 K temperature kinetic energy is E' .The value of E'/E is :
(1) 1.33 (2) $\sqrt{\left(\frac{4}{3}\right)}$ (3) $\frac{16}{9}$ (4) 2

18. If temperature becomes triple, the root mean square velocity of gas molecules will be :
(1) $\upsilon\sqrt{2}$ (2) $\upsilon/\sqrt{3}$ (3) $\sqrt{3}\,\upsilon$ (4) same
[υ is the root mean square velocity of gas molecules at temperature T]

19. When temperature of a gas is increased then which of the following statements is always true ?
(1) Work is done on the gas (2) Heat is supplied to gas
(3) Internal energy of gas is increased (4) pressure of gas remains unchanged.

20. An increase in pressure required to decrease the 200 liters volume of a liquid by 0.004% in pipa is (Bulk modulus of the liquid = 2100 MPa)
(1) 188 kPa (2) 8.4 kPa (3) 18.8 kPa (4) 84 kPa

21. If 2g of helium is enclosed in a vessel at NTP, how much heat should be added to it to double the pressure? (Specific heat of helium = 3 J/gm K)
(1) 1638 J (2) 1019 J (3) 1568 J (4) 836 J

22. If an ideal flask containing hot coffee is shaken, the temperature of the coffee will :
(1) decrease (2) increase (3) remain same
(4) decrease if temperature is below 4ºC and increase if temperature is equal to or more than 4ºC

23. At what temperature volume of an ideal gas at 0ºC becomes triple ?
(1) 546ºC (2) 182ºC (3) 819ºC (4) 646ºC

24. When temperature of an ideal of an ideal gas is increased from 27ºC to 227ºC, its rms speed is changed from 400 m/s to v_s. The v_s is :
(1) 516 m/s (2) 450 m/s (3) 310 m/s (4) 746 m/s

25. An electric fan is switched on in a closed room. The air in the room is
(1) cooled
(2) heated
(3) maintains its temperature
(4) heated or cooled depending on the atmospheric pressure

26. The root mean square and most probable speed of the molecules in a gas are

(1) same (2) different
(3) cannot say (4) depends on nature of the gas

27. Boiling water is changing into steam. Under this condition, the specific heat of water is
(1) zero (2) one (3) Infinite (4) less than one

28. Two sample A and B are initially kept in the same state. The sample A is expanded through an adiabatic process and the sample B through an isothermal process upto the same final volume. The final pressures in A and B are p_A and p_B respectively.
(1) $p_A > p_B$ (2) $p_A = p_B$ (3) $p_A < p_B$
(4) The relation between p_A and p_B cannot be deduced.

29. Let T_a and T_b be the final temperature of the samples A and B respectively in the previous question then :
(1) $T_a < T_b$ (2) $T_a = T_b$ (3) $T_a > T_b$
(4) The relation between T_a and T_b cannot be deduced.

30. Let ΔW_a and ΔW_b be the work done by the systems A and B respectively in the previous question then
(1) $\Delta W_a > \Delta W_b$ (2) $\Delta W_a = \Delta W_b$ (3) $\Delta W_a < \Delta W_b$
(4) The relation between W_a and W_b cannot be deduced

OBJECTIVE RESPONSE SHEET (ORS)

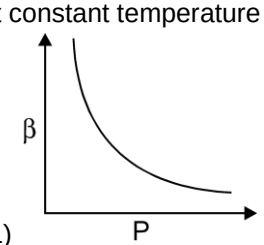
PART - II : PRACTICE QUESTIONS

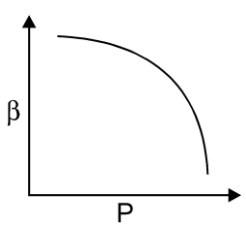
1. Two balloons are filled, one with pure He gas and the other by air, respectively. If the pressure and temperature of these balloons are same, then the number of molecules per unit volume is
(1) more in the He filled balloon (2) same in both balloons
(3) more in air filled balloon (4) in the ratio of 1 : 4

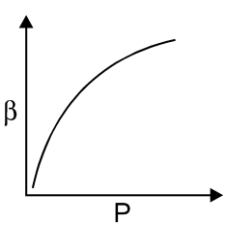
2. Two containers of equal volume contain the same gas at pressure p_1 and p_2 and absolute temperature T_1 and T_2 repectively. On joining the vessels the gas reaches a common pressure p and common temperature T. The ratio p/T is equal to
(1) $\frac{p_1}{T_1} + \frac{p_2}{T_2}$ (2) $\frac{p_1T_1 + p_2T_2}{(T_1 + T_2)^2}$
(3) $\frac{p_1T_2 + p_2T_1}{(T_1 + T_2)^2}$ (4) $\frac{p_1}{2T_1} + \frac{p_2}{2T_2}$

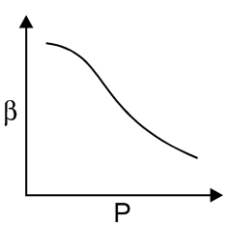
3. If a diatomic gas is supplied heat Q in a process, it performs work $\frac{Q}{4}$. What is molar heat capacity of the gas in this process.
(1) $\frac{2}{5}R$ (2) $\frac{5}{2}R$ (3) $\frac{10}{3}R$ (4) $\frac{6}{7}R$

4. Which of the following graphs correctly represents the variation of $\beta = -(dV/dP)/V$ with P for an ideal gas at constant temperature ?

(1) 

(2) 

(3) 

(4) 

5. A mono–atomic ideal gas is compressed from volume V to V/2 through various process. For which of the following processes final pressure will be maximum :
(1) isobaric (2) isothermal (3) adiabatic (4) PV^2 = constant

6. An ideal gas initially at a state (P_1, V_1) is allowed to expand isothermally to a state (P_2, V_2). Then the gas is compressed adiabatically to its initial volume V_1. Let the final pressure be P_3 and the work done by the gas during the whole process be W, then
(1) $P_3 > P_1$ and $W < 0$ (2) $P_3 > P_1$ and $W > 0$
(3) $P_3 < P_1$ and $W > 0$ (4) $P_3 < P_1$ and $W < 0$

7. 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
(1) 10 KJ (2) 20 KJ (3) 30 KJ (4) 0 KJ

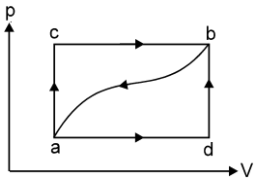
8. If E is translation kinetic energy per unit volume of an ideal gas than pressure of the gas is given by relation:
(1) $P = \frac{3}{2}E$ (2) P = 3E (3) $P = \frac{2E}{3}$ (4) $P = \frac{E}{3}$

9. 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)
(1) 3 (2) 4 (3) 5 (4) 6

10. Which of the following is correct for the molecules of a gas in thermal equilibrium ?
(1) All have the same speed
(2) All have different speeds which remain constant
(3) They have a certain constant average speed
(4) They do not collide with one another.

Comprehension # 1

When a system is taken from state ‘a’ to state ‘b’ along the path ‘acb’, it is found that a quantity of heat Q = 200 J is absorbed by the system and a work W = 80J is done by it. Along the path ‘adb’, Q = 144J.



11. The work done along the path ‘adb’ is
(1) 6J (2) 12 J (3) 18 J (4) 24 J

12. The work done on the system along the curved path ‘ba’ is 52J, heat abosrbed is
(1) – 140 J (2) – 172 J (3) 140 J (4) 172 J

13. U_a = 40J, value of $U_b$will be
(1) – 50 J (2) 100 J (3) – 120 J (4) 160 J

14. U_d = 88 J, heat absorbed for the path ‘db’ is
(1) – 72 J (2) 72 J (3) 144 J (4) – 144 J

Comprehension # 2

A monoatomic ideal gas is filled in a nonconducting container. The gas can be compressed by a movable nonconducting piston. The gas is compressed slowly to 12.5% of its initial volume.

15. The percentage increase in the temperature of the gas is
(1) 400% (2) 300% (3) – 87.5% (4) 0%

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

(1) 32 (2) 1 (3) 1/32 (4) 4

17. The ratio of work done by the gas to the change in internal energy of the gas is
(1) 1 (2) –1 (3) ∞ (4) 0

APSP Answers

PART-I

1.	(2)	**2.**	(4)	**3.**	(4)	**4.**	(2)	**5.**	(3)	**6.**	(4)	**7.**	(4)
8.	(4)	**9.**	(3)	**10.**	(2)	**11.**	(1)	**12.**	(3)	**13.**	(2)	**14.**	(4)
15.	(1)	**16.**	(3)	**17.**	(1)	**18.**	(3)	**19.**	(3)	**20.**	(4)	**21.**	(1)
22.	(2)	**23.**	(1)	**24.**	(1)	**25.**	(2)	**26.**	(2)	**27.**	(3)	**28.**	(3)
29.	(1)	**30.**	(3)										

PART - II

1.	(2)	**2.**	(4)	**3.**	(3)	**4.**	(1)	**5.**	(4)	**6.**	(1)	**7.**	(3)
8.	(3)	**9.**	(2)	**10.**	(3)	**11.**	(4)	**12.**	(2)	**13.**	(4)	**14.**	(2)
15.	(2)	**16.**	(3)	**17.**	(2)								