**CPP-11**
**FS JEE(M) &**
**ADVANCED**

# Physics

## Chapterwise Practise Problems (CPP) for JEE (Main & Advanced)

## Chapter - Thermodynamics and Kinetic Theory of Gases

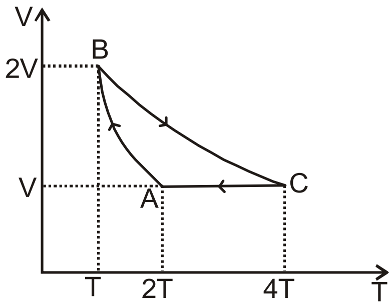
Level-1

### SECTION - A

**Straight Objective Type**

This section contains multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct.

1. Figure shows the VT diagram for helium gas in a cyclic process. Equation of state for process AB is VT = constant. Equation of state process BC is $TV^2$ = constant. The raio of maximum to minimum temperature is 4. The ratio of maximum to minimum pressure will be




(A) 2 (B) 4

(C) 6 (D) 8

2. Which of the following will have maximum total kinetic energy of temperature 300K

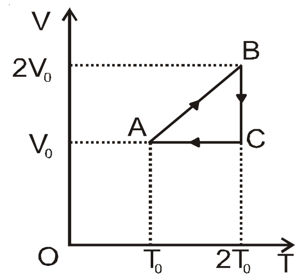
(A) 1 kg of $H_2$

(B) 1 kg of He

(C) $\frac{1}{2}$ kg of $H_2$ + $\frac{1}{2}$ kg of He

(D) $\frac{1}{4}$ kg of $H_2$ + $\frac{3}{4}$ kg of He

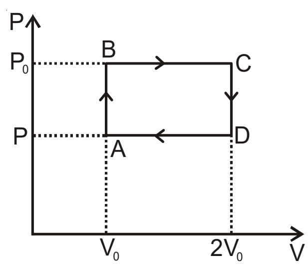
3. An ideal monoatomic gas undergoes a cyclic process ABCA as shown in the figure. The ratio of heat absorbed during AB to the work done on the gas during BC is




(A) $\frac{5}{2\ell n2}$ (B) $\frac{5}{3}$

(C) $\frac{5}{4\ell n2}$ (D) $\frac{5}{6}$

4. A sample of an ideal monoatomic gas is taken through a cyclic process whose P-V graph is in the shape of the rectangle consisting of isochoric and isobaric processes. If maximum pressure of the gas is $P_0$. The value of minimum pressure P, of the gas so that efficiency of cycle is 20% is




(A) 0.3 $P_0$

(B) 0.4 $P_0$

(C) 0.8 $P_0$

(D) Data insufficient

5. Assume the earth as a uniform solid sphere which rotates about its own axis. Co-efficient of linear expansion of the earth is $1 \times 10^{-4}/°C$, Due to global warming, if the temperature of the earth is increased by $\Delta T = 10°C$, then the interval of a day (time period of earth's sprin) would :

(A) Increase by 0.1% (B) Decrease by 0.1%

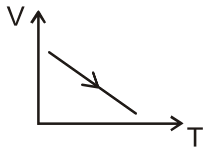
(C) Increase by 0.2% (D) Decrease by 0.2%

## SECTION - B

### Multiple Correct Answer Type

This section contains multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE** is/are correct.

6. A fixed amount of gas undergoes a process as shown in V-T diagram. Choose the correct option(s).



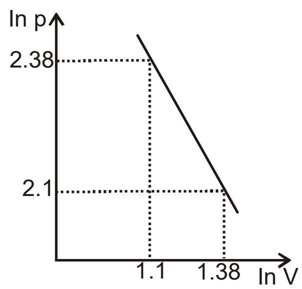

(A) The process cannot be represented as $P^aV^bT^c$ = constant, where a, b, c are real numbers.

(B) Specific heat capacity for the process is dependent on temperature if P is not constant

(C) Pressure of the gas monotonically decreases

(D) Pressure of the gas monotonically increases

7. Figure shows graph of log p versus log V (p-pressure, V-volume) for an ideal gas. The gas may be




(A) Monoatomic and undergoing an adiabatic change.

(B) Monoatomic and undergoing an isothermal change

(C) Diatomic and undergoing an adiabatic change

(D) Diatomic and undergoing an isothermal change

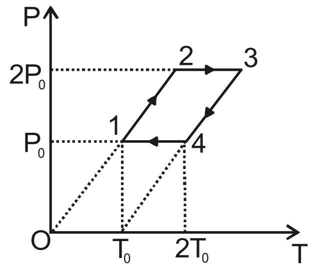
## SECTION - C

### Linked Comprehension Type

This section contains paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE/MORE** is correct.

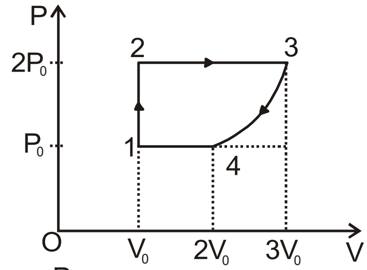
**Paragraph for Question Nos. 8 to 10**

One mole of an ideal monoatomic gas is taken through the cycle process 1 – 2 – 3 – 4 – 1 as shown in the figure. The initial volume of gas is $V_0$.

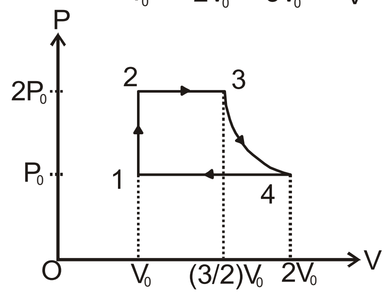



8. The P-V diagram of the cyclic process will be

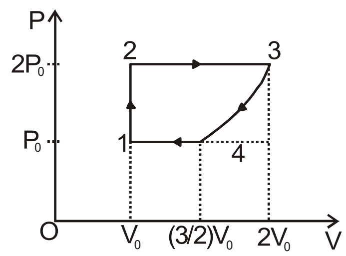
(A)



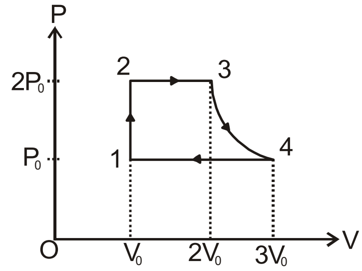

(B)




(C)




(D)



9. The work done by the gas in one cycle is

(A) $RT_0(3 - \ln 2)$  (B) $RT_0 \ln 2$

(C) $\frac{RT_0}{2}\ln 2$  (D) $\frac{RT_0}{2}(3 - \ln 2)$

10. The work done by the gas in the process 3 to 4 is

(A) $RT_0(3 - \ln 2)$

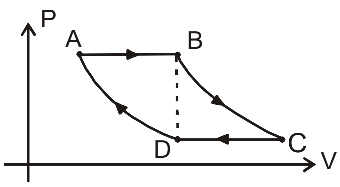
(B) $RT_0 \ln 2$

(C) $\frac{RT_0}{2}\ln 2$

(D) $\frac{RT_0}{2}(3 - \ln 2)$

**Paragraph for Question Nos. 11 and 12**

Indicator diagram for 1 mole of a monoatomic ideal gas is shown in the figure. It consist of two isobar and two isotherm. The temperature of isotherms are 300 K and 600 K. The minimum volume of gas is given $V_1$ and maximum volume is $4V_1$. Heat absorbed in process AB, BC, CD and DA are $Q_1$, $Q_2$, $Q_3$ and $Q_4$ respectively and area of cycle is A. Now answer the following questions




11. Efficiency of cycle

(A) $\frac{A}{Q_1}$

(B) $\frac{A}{Q_1 + Q_2 + Q_3 + Q_4}$

(C) $\frac{A}{Q_1 + Q_2}$

(D) $\frac{Q_1 + Q_2 + Q_3 + Q_4}{Q_1}$

12. The value of $Q_1$

(A) 450 R  (B) 750 R

(C) 200 R  (D) Zero

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**SECTION-D**

**Matrix-Match Type**

This **Section D** have "match the following" type question. Question contains two columns, **Col-I** and **Col-II**. Match the entries in **Col-I** with the entries in **Col-II**. One or more entries in **Col-I** may match with one or more entries in **Col-II**.

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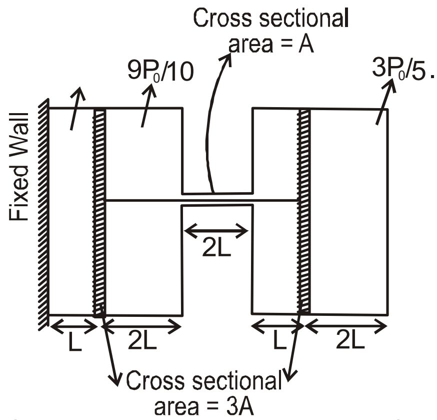
13. Figure shows a vessel whose left end is attached to the wall. Vessel contain two pistons of equal mass connected with light string. There is no friction anywhere. Initial pressure and dimension of each part is shown in the figure. Temperature of system is always equal to that of surrounding. Now pistons are pulled by a distance L to the right from the initial condition as shown in the figure and released at t = 0. Atmospheric pressure is $P_0$. neglect effect of gravity on the system and match the following



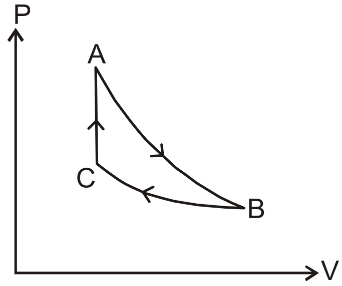

| Column I | Column II |
|---|---|
| (A) Pressure of the gas in right most section at t = 0 relative to initial value | (p) Increase |
| (B) Pressure of the gas in middle section at t = 0 relative to initial value | (q) Decrease |
| (C) Tension in the thread at t = 0 relative to initial value | (r) Remain same |
| (D) Magnitude of force exerted by gas on the fixed wall at t = 0 relative to initial value of force on the fixed wall | (s) Doubled |
| | (t) Halved |

## SECTION-E

**Integer Answer Type**

This section contains Integer type questions. The answer to each of the questions is an integer.

14. An ideal gas undergoes a cyclic process shown in the graph, in which one process is isochoric, one process is isothermal and one process is adiabatic. During the isothermal process, 40J, heat is released by the gas, and during the isochoric process, 80 J heat is absorbed by the gas. If work done by the gas during adiabatic process is $W_1$ and work done on the gas during isothermal process is $W_2$ then $\frac{W_1}{W_2}$ be equal to

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## SECTION - A

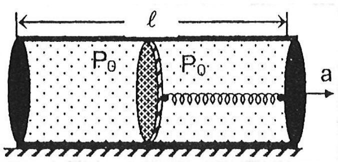
### Straight Objective Type

This section contains multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct.

1. An adiabatic piston of mass m equally divides an insulator container of length $\ell$. One end of a light spring is connected to the piston and other end to the right wall. The container contains equal volume $V_0$ of helium gas in each part. The pressure on both side of piston is $P_0$. The container starts moving with acceleration a towards right, find the elongation in the spring when acceleration of the piston equals acceleration of container. (Assume displacement of the piston << $\ell$)

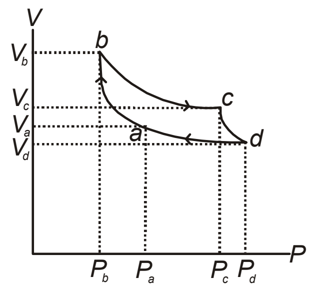
(A) $\dfrac{ma}{\left[k+\dfrac{8\gamma P_0 V_0}{\ell^2}\right]}$

(B) $\dfrac{2ma}{\left[k+\dfrac{\gamma P_0 V_0}{8\ell^2}\right]}$




(C) $\dfrac{ma}{\left[k+\dfrac{P_0 V_0 \gamma}{\ell^2}\right]}$ (D) $\dfrac{2ma}{\left[k+\dfrac{P_0 V_0}{\ell^2}\right]}$

2. A cyclic process ABCD shown in V-P diagram with two adiabatic and two isothermal process for n mole of monoatomic gas is shown in the figure. The ratio of $\dfrac{P_b}{P_c}$ is:

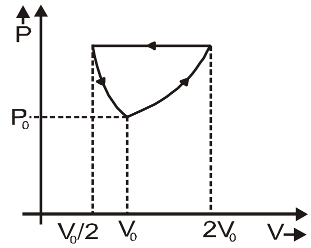


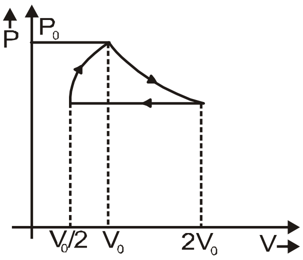

(A) $\dfrac{P_a}{P_d}$

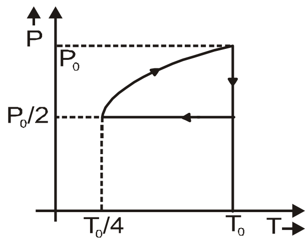
(B) $\left(\dfrac{P_a}{P_d}\right)^{\gamma-1}$

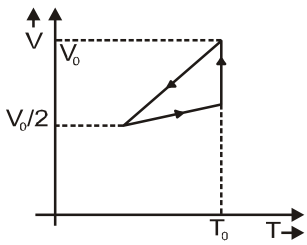
(C) $\dfrac{P_d}{P_a}$ (D) $\left(\dfrac{P_d}{P_a}\right)^{\gamma}$

3. One mole of an ideal gas at pressure $P_0$ volume $V_0$ and temperature $T_0$ is expanded isothermally to twice its volume and then compressed at constant pressure to $(V_0/2)$ and the gas is brought back to original state by a process in which $P \propto V$ (Pressure is directly proportional to volume). The correct representation of process is

(A)



(B)



(C)



(D)


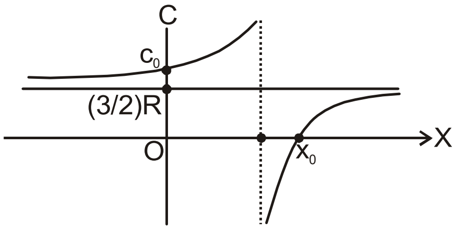

4. A one dimensional gas is a hypothetical gas with molecules that can move along only a single axis. The following table gives four situations, the velocities in meter per second of such a gas having four molecules. The plus and minus sign refer to the direction of the velocity along the axis

| | | | | |
|---|---|---|---|---|
| a | –2 | +3 | –4 | +5 |
| b | +1 | –3 | +4 | –6 |
| c | +2 | +3 | +4 | +5 |
| d | +3 | +3 | –4 | –5 |

In which situation root-mean-square speed of the molecules is greatest

(A) a (B) b
(C) c (D) d

5. One mole of an ideal gas is taken along the process in which $PV^x$ = constant. The graph shown represents the variation of molar heat capacity of such a gas with respect to 'x'. The values of '$c_0$' and $x_0$' respectively are given by




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

(C) $\frac{7}{2}R, \frac{7}{2}$ (D) $\frac{5}{2}R, \frac{7}{5}$

6. One mole of a diatomic gas undergoes a process $P = \frac{P_0}{1+\left(\frac{V}{V_0}\right)^3}$, where $P_0$, $V_0$ are constants. The translational kinetic energy of the gas when $V = V_0$ is given by

(A) $\frac{3P_0V_0}{2}$ (B) $P_0V_0$

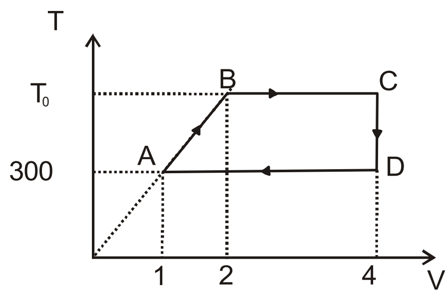
(C) $\frac{3P_0V_0}{4}$ (D) $\frac{5P_0V_0}{2}$

7. The gas inside a spherical bubble expands uniformly and slowly so that its radius increases from R to 2R. Let the atmospheric pressure be p0 and surface tension be S. The work done by the gas in the process is

(A) $\frac{28\pi p_0R^3}{3} + 24\pi SR^2$ (B) $\frac{25\pi p_0R^3}{3} + 24\pi SR^2$

(C) $\frac{25\pi p_0R^3}{3} + \frac{23\pi SR^2}{2}$ (D) None of these

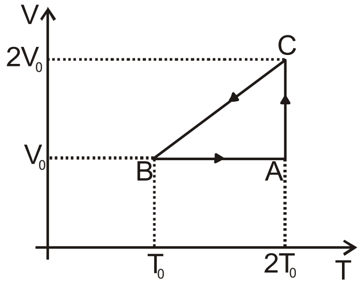
8. A sample of He gas is undergoes a cyclic process ABCDA as shown. Here symbols have their usual meaning. Then which of the following options is not true.




(A) $\frac{P_A}{P_B} = 1$ (B) $\frac{T_B}{T_A} = 2$

(C) $\frac{|\Delta Q|_{BC}}{|\Delta Q|_{DA}} = 1$ (D) $\frac{P_{max}}{P_{min}} = 3$

9. The efficiency of an ideal gas with adiabatic exponent $\gamma$ for the shown cyclic process would be




(A) $\frac{(2\ln 2-1)}{\gamma/(\gamma-1)}$ (B) $\frac{(1-2\ln 2)}{\gamma/(\gamma-1)}$

(C) $\frac{(2\ln 2+1)}{\gamma/(\gamma-1)}$ (D) $\frac{2\ln 2-1}{2\ln 2+\left(\frac{1}{\gamma-1}\right)}$

10. A cubical vessel of edge 1m and total thermal resistance (of its walls) is $\frac{1}{R}$ (where, R is universal gas constant) has a small hole in one of its walls. It is kept in a very big closed chamber whose temperature $T_0$ remains constant. In the chamber and vessel, a monoatomic gas is filled at a same constant pressure $P_0$. At time t = 0, temperature of the gas in the vessel is $T_1$. When temperature of the gas in the vessel becomes 0.8 $T_0$, rate of change of moles in it will be (in moles/sec)

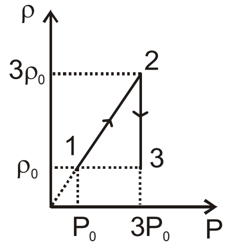
(A) $\frac{1}{10}$ (B) $\frac{1}{6}$

(C) $-\frac{1}{10}$ (D) $-\frac{1}{6}$

11. A gas is enclosed in a vessel at a constant temperature at a pressure of 2.0 atmosphere and volume litres. Due to a leak in the vessel after some time pressure is reduced to 1.5 atmosphere. As a result from the vessel,

(A) 25% of the gas has escaped out
(B) 50% of the gas has escaped out
(C) 75% of the gas has escaped out
(D) 100% of the gas has escaped out

12. The density $\rho$ vs pressure P graph of an ideal monoatomic gas undergoes a process as shown in figure. Find the total work done during the complete process. Molecular weight of gas is M and number of moles is 1.



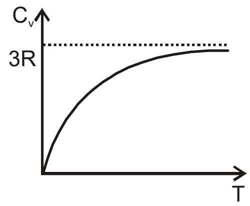

(A) $\frac{P_0 M}{\rho_0}(1-\ln 3)$

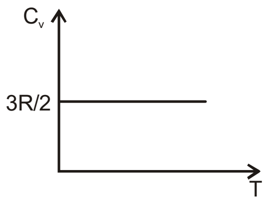
(B) $\frac{P_0 M}{\rho_0}(2-\ln 3)$

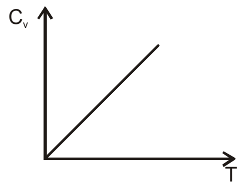
(C) $\frac{P_0 M}{\rho_0}(3-\ln 3)$

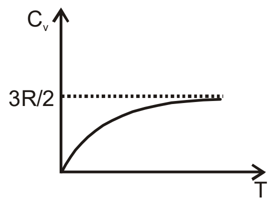
(D) None of these

13. Which of the following curves correctly depicts the variation of specific heat of an ideal monoatomic gas at constant volume ($C_V$) with temperature T.

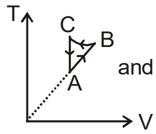
(A)



(B)


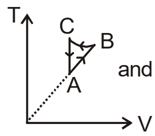

(C)



(D)


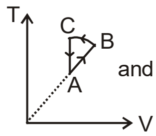

14. Two moles of an ideal gas is initially in state A having pressure $1.01 \times 10^5$ N/m$^2$ and temperature 300 K. Keeping pressure constant, the gas is taken to state B. Temperature at B is 500 K. The gas is then taken to state C in such a way that its temperature increases and volume decreases. Also from B to C the magnitude of $\frac{dT}{dV}$ increases. The volume of gas at C is equal to volume of gas at A. Now the gas is taken to initial state A keeping volume constant. A total of 1200 J of heat is with drawn from the sample in the cyclic process. The T – V graph for the cyclic process and work done in the path B to C are respectively (Take R = 8.3 J/k/mol.)

(A)


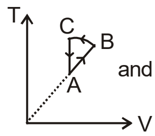
and –4520J

(B)


and –460J

(C)


and –4520J

(D)


and –460J

## SECTION - B
### Multiple Correct Answer Type

This section contains multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE** is/are correct.

15. Two cylinder A and B of equal capacity are connected to each other via a stop cock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. If the stop cock is suddenly opened then

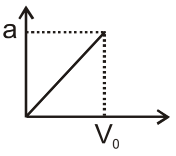
(A) Final pressure of gas in A and B is 0.5 atm

(B) There is no change in internal energy of the system

(C) The intermediate states of the system (before setting to the final equilibrium state) are well defined

(D) Through out the process, temperature remains constant

16. Graph shows a hypothetical speed distribution for a sample of N gas particle (for V > $V_0$; $\frac{dN}{dV}=0$, $\frac{dN}{dV}$ is rate of change of number of particles with change velocity)



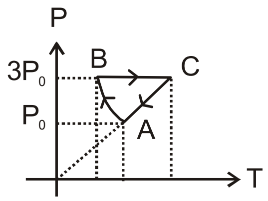

(A) The ratio $V_{avg}/V_0$ is equal to 2/3

(B) The ratio $V_{rms}/V_0$ is equal to $1/\sqrt{2}$

(C) Three fourth of the total particle has a speed between 0.5 $V_0$ and $V_0$

(D) The value of $aV_0$ is 2N

17. One mole of monoatomic gas is taken through cyclic process shown below. $T_A$ = 300 K. Process AB is defined as PT = constant



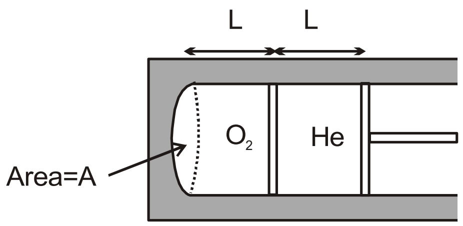

(A) Work done in process AB is –400 R

(B) Change in internal energy in process CA is 900 R

(C) Heat transferred in the process BC is 2000 R

(D) Change in internal energy in process CA is –900 R

18. An insulating cylinder contains equal volumes of He and $O_2$ separated by a massless freely moving adiabatic piston as shown. The gas is compressed by moving the insulating piston so that volume of He becomes half. Select the correct alternative (s)




(A) Pressure in He chamber will be equal to pressure in $O_2$ chamber

(B) Pressure in He chamber will be less than pressure in $O_2$ chamber

(C) Volume of He chamber will be equal to volume of $O_2$ chamber

(D) Volume of $O_2$ chamber will be $\frac{(LA)}{(2)^{25/21}}$

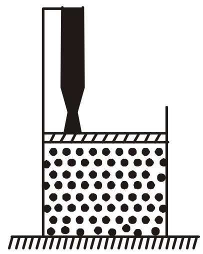
**SECTION - C**

**Linked Comprehension Type**

This section contains paragraph. Based upon this paragraph, 2 multiple choice questions have to be answered. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE/MORE** is correct.

**Paragraph for Question Nos. 19 and 20**

One mole of an ideal gas is enclosed in a vertical cylinder, under a weightless piston. The temperature of the gas varies according to the law $T = T_0(1 + bt^2)$ where b is a constant. Atmospheric pressure $P_0$. Sand is falling very slowly through a sand hopper. Cross-section area of the piston is A.



19. At what rate sand should fall on the piston so as to keep the volume of the gas constant ?

(A) $\frac{2P_0A}{gt}$ (B) $\frac{P_0btA}{g}$

(C) $\frac{2P_0btA}{g}$ (D) $\frac{P_0A}{gt}$

20. Find the heat supplied to the gas till the pressure inside the cylinder becomes twice of the pressure at t = 0. Take the gas to monoatomic.

(A) $\frac{3RT_0}{2}$ (B) $3RT_0$

(C) $\frac{5RT_0}{2}$ (D) $5RT_0$

**Paragraph for Question Nos. 21 and 22**

In a flexible balloon, 2 moles of $CO_2$ having initial volume of $1 m^3$ at a temperature of 27°C is filled. The gas is first expanded to thrice its initial volume isobarically and then expanded adiabatically so as to attain its initial temperature. Assuming gas is ideal and $R = \frac{25}{3}$ $Jmol^{-1}K^{-1}$ and neglecting the work done against balloon -

21. Change in internal energy of the gas in the isobaric process is

(A) $1.2 \times 10^6$ J (B) $2.5 \times 10^4$ J

(C) $3 \times 10^5$ J (D) $0.5 \times 10^3$ J

22. Work done by the gas in the whole process is

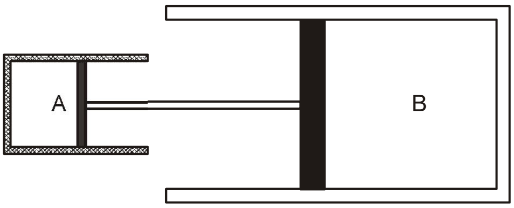
(A) 35 kJ (B) 25 kJ

(C) 40 kJ (D) None of these

**Paragraph for Question Nos. 23 to 25**

Two fixed and horizontal cylinders A and B having pistons (both massless) of cross sectional area 100 $cm^2$ and 200 $cm^2$ respectively, are connected by massless rod. The piston can move freely without friction.

The cylinder A contains 100 gms of an ideal gas ($\gamma$ = 1.5) at pressure $10^5$ N/m$^2$ and temperature $T_0$. The cylinder B contains identical gas at same temperature $T_o$ but has different mass. The piston are held at the state such that volume of gas in cylinder A and cylinder B are same and is equal to $10^{-2}$m$^3$. The walls and pistion of cylinder A are thermally insulated where as gas in cylinder B is maintained at constant temperature $T_o$. The whole system is in vacuum. Now the pistons are released and displaced quasistatically until mechanical equilibrium is reached at the state when the volume of gas in cylinder A becomes 25 × $10^{-4}$ m$^3$




23. The mass of gas in cylinder B is

(A) 200 gms (B) 600 gms
(C) 500 gms (D) 1 Kg

24. The change in internal energy of gas in cylinder A is

(A) 2000 J (B) 1000 J
(C) 500 J (D) 3000 J

25. The compressive force in the connecting rod at equilibrium is

(A) 2000 N (B) 4000 N
(C) 8000 N (D) 10000 N

**Paragraph for Question Nos. 26 to 28**

A cylindrical tube of volume $3V_0$ divided in two parts by a frictionless separator. The wall of tube are adiabatic but separator is conducting. Ideal gas is filled in the two parts. When the separator is kept in such a position so that left part has volume $V_0$ and pressures are $p_1$ and $p_2$ in the left part and right part respectively. The separator is slowly slid and is released at a point where it can stay in equilibrium.

26. If initial temperature is T and final temperature and pressure are $T_f$ and $P_f$ respectively. Then $\frac{P_f}{T_f}$ is equal to

(A) $\frac{2p_1+p_2}{3T}$ (B) $\left(\frac{p_1+2p_2}{2T}\right)$

(C) $\left(\frac{p_1+2p_2}{3T}\right)$ (D) $\left(\frac{2p_1+p_2}{2T}\right)$

27. Final volume of the right part (initially $2v_0$) is equal to

(A) $\frac{6P_2V_0}{P_1+2P_2}$ (B) $\frac{3P_1V_0}{P_1+2P_2}$

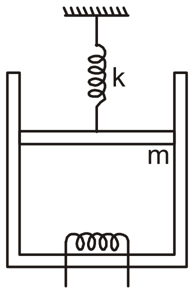
(C) $\frac{6P_1V_0}{2P_1+P_2}$ (D) $\frac{6P_2V_0}{2P_1+P_2}$

28. Temperature of the system

(A) Will increase (B) Will decrease
(C) Remain same (D) Can't say anything

**Paragraph for Question Nos. 29 and 30**

2000 mol of an ideal diatomic gas is enclosed in a vertical cylinder fittted with a piston and spring as shown in the figure. Initially, the spring is compressed by 5cm and then the electric heater starts supplying energy to the gas at constant rate of 100J/s and due to conduction through walls of cylinder and radiation, 20 J/s is lost to surroundings.




[Take k = 1000 N/m, g =10m/s$^2$, Atmospheric pressure $P_0$ = $10^5$N/m$^2$, cross-section area of piston $A_0$ = 50 cm$^2$ , mass of piston m = 1kg, R = 8.3 kJ/mol-K]

29. The initial pressure of the gas is

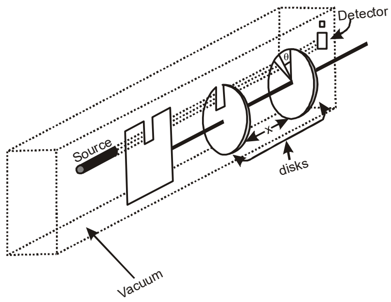
(A) 1 $P_0$ (B) 1.02 $P_0$
(C) 1.10 $P_0$ (D) 1.12 $P_0$

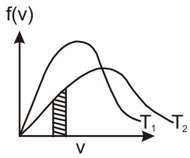
30. Approximate work done by the gas in t = 5 s is

(A) 300 J (B) 400 J
(C) 114.3 J (D) 153.6 J

**Paragraph for Question Nos 31 to 33**

Figure shows one experimental scheme for measuring the distribution of molecular speed. A substance is vaporized in source, molecules of the vapour escape through an aperture in the source. Slit blocks all molecules except those in a narrow beam which is aimed at a pair of relatively rotating discs. A molecule passing from the first disk is blocked by the second disk unless it arrives just as the slit in the second disk is lined up with the beam. This range of speed can be varied by changing disk rotation speed. We can measure how many molecules lie within each of various speed ranges, by the help of plotting a graph between f(v)called distribution function and speed v, $f(v)=\frac{dN_V}{dv}$ where $dN_v$ is the number of molecules with speed from v to v + dv]




31. Let the spacing between the two disks is x, and angular spacing between the slits on the disks is $\theta$. Find the velocity of a molecule able to pass through the 2nd disc rotating with an angular velocity $\omega$, when first disc is stationary (R is radius of the disc)

(A) $v=\frac{\omega x}{\theta}$
(B) $v=\frac{\theta}{\omega R}$
(C) $v=\frac{R\omega}{\theta}$
(D) $v=\frac{\theta R}{\omega}$

32. If function f(v) described the actual distribution of molecular speed is $f(v) = av^2e^{-bv^2}$, then the most probable speed will be (Here, a and b are temperature dependent quantities)

(A) $\sqrt{\frac{a}{b}}$

(B) $\sqrt{\frac{1}{a}}$

(C) $\sqrt{\frac{1}{b}}$

(D) None of these

33. The area shown under the distribution curve will give

(A) Kinetic energy
(B) Potential energy
(C) Internal energy
(D) Number of particles

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# ANSWERS

## LEVEL-1

| | | | | | |
|---|---|---|---|---|---|
| 1. (D) | 2. (A) | 3. (C) | 4. (A) | 5. (C) | 6. (A,B,D) |
| 7. (B,D) | 8. (B) | 9. (B) | 10. (B) | 11. (C) | 12. (B) |
| 13. (A-p,s, B-r ,C-q, D-q,t) | | 14. (2) | | | |

## LEVEL-2

| | | | | | |
|---|---|---|---|---|---|
| 1. (A) | 2. (A) | 3. (C) | 4. (B) | 5. (B) | 6. (C) |
| 7. (A) | 8. (D) | 9. (D) | 10. (C) | 11. (A) | 12. (B) |
| 13. (B) | 14. (A) | 15. (A,B) | 16. (A,B,C,D) | 17. (A,C,D) | 18. (A,D) |
| 19. (C) | 20. (A) | 21. (B) | 22. (A) | 23. (D) | 24. (A) |
| 25. (C) | 26. (C) | 27. (A) | 28. (B) | 29. (D) | 30. (B) |
| 31. (A) | 32. (C) | 33. (D) | | | |

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