Physicsaholics

DPP – 1 (KTG)

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Q 1. The gas molecules are not accumulated at the bottom of the container because -
(a) These do not have gravitation force between them
(b) Molecules have less mass and high velocities and therefore gravitational force is not effective
(c) The direction of motion of molecules is changing on account of collisions.
(d) These is cohesive force between the gas molecules and the wall of the container acting in all direction.

Q 2. Which of the following statement is not according to the postulates of kinetic theory of gases.-
(a) Gas molecules are of small size
(b) Gas molecules are always in motion with all possible velocities
(c) There is no force between the molecules
(d) None of these

Q 3. A container of volume 30 litre is filled with an ideal gas at one atmosphere pressure and 0° C temperature. Keeping the temperature constant some mass of gas is allowed to escape from the container. Due to this the pressure of the gas decreases to 0.78 atmos from the previous one. If the density of the gas at N.T.P. is 1.3 gm/litre, the mass of the gas remaining is
(a) 30.4 gm (b) 25.5 gm
(c) 18.3 gm (d) 12.7 gm

Q 4. A container is filled with 7 gram nitrogen and 11 gram CO_2 at 290 K. If the pressure of the mixture is 1 atmos, then the density of mixture is -
(a) 1.25 kg/m^3 (b) 1.35 kg/m^3
(c) 1.50 kg/m^3 (d) 1.75 kg/m^3

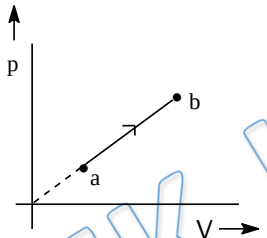
Q 5. A closed and big compartment containing gas is moving with some acceleration in horizontal direction, neglect effect of gravity. Then the pressure in the compartment is
(a) Same everywhere
(b) Lower in the front side
(c) Lower in the rear side
(d) Lower in the upper side

Q 6. At the top of mountain, a thermometer reads 280 K and a barometer reads 70 cm of Hg. At the bottom of mountain, they read 300 K and 76 cm of Hg. Find the ratio of densities of air at the top and that at the bottom
Z(a) 0.80

(b) 0.89
(c) 0.99
(d) 0.79

Q 7. A cylindrical vessel of height 500 mm has an orifice (small hole) at its bottom. The orifice is initially closed and water is filled in it up to height H. Now the top is completely sealed with a cap and the orifice at the bottom is opened. Some water comes out from the orifice and the water level in the vessel become steady with height of water column being 200 mm. Find the fall in height (in mm) of water level due to opening of the orifice [take atmospheric pressure = 1.0×10^5 N/m^2, density of water = 1000 kg/m^3 and g = 10 m/s^2. Neglect any effect of surface tension].

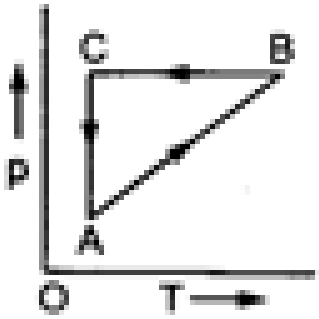
Q 8. In the P-V diagram shown in the figure, as one moves from a to b, match the following :

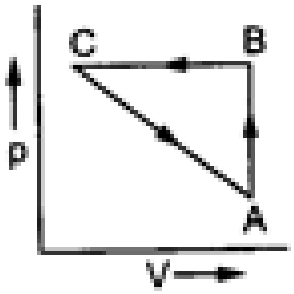


Column – I	**Column - II**
a) Temperature	p) Increasing
b) Density	q) Decreasing
c) V – T graphr)	Straight Line
d) P – T graph	s) Parabola
	t) Hyperbola

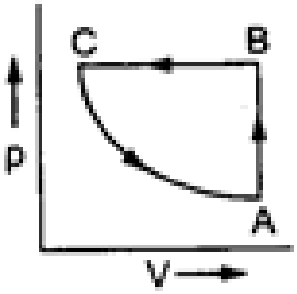
Q 9. A vessel contains 1 mole of o_2 gas (molar mass 32) at a temperature T. The pressure of the gas is P. An identical vessel containing one mole of He gas (molar mass 4) at a temperature 2T has a pressure of x (P) where x =

Q 10. A cyclic process is shown on the p-T diagram. Which of the curves show the same process on a p-V diagram?

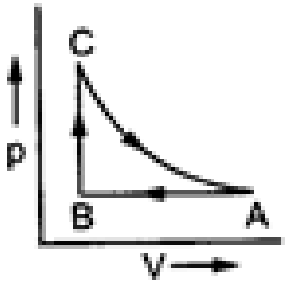




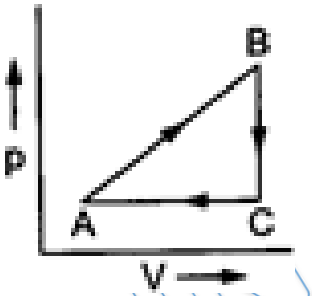
(a)



(b)

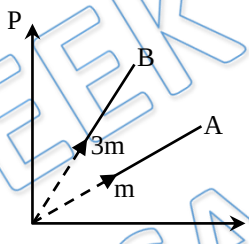


(c)



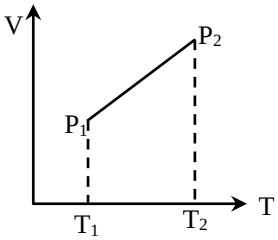
(d)

Q 11. Two different masses m and 3m of an ideal gas are heated separately in a vessel of constant volume, the pressure P and absolute temperature T, graphs for these two cases are shown in the figure as A and B. The ratio of slopes of curves B to A is –



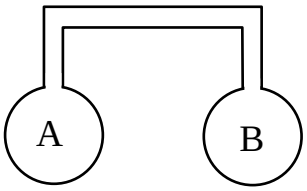
(a) 3 : 1
(b) 1 : 3
(c) 9 : 1
(d) 1 : 9

Q 12. From the following V-T diagram we can conclude



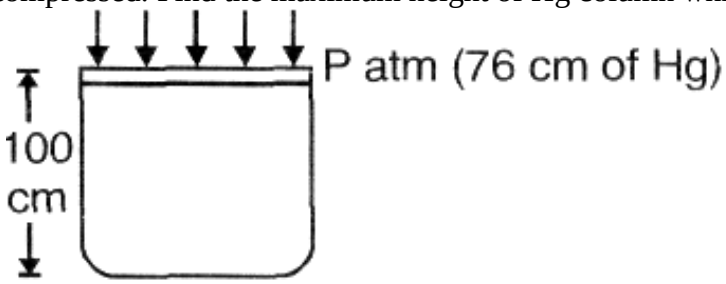
(a)$P_1 = P_2$
(b) $P_1 > P_2$
(c) $P_1 < P_2$
(d) None of these

Q 13. Two spherical vessels of equal volumes are connected by a narrow tube. The apparatus contain an ideal gas at one atmosphere and 300K. Now if one vessel is immersed in a bath of constant temperature 600 K and the other in a bath of constant temperature 300 K then the common pressure will be –



(a)1 atm
(b) 4/5 atm
(c) 4/3 atm
(d) 3/4 atm

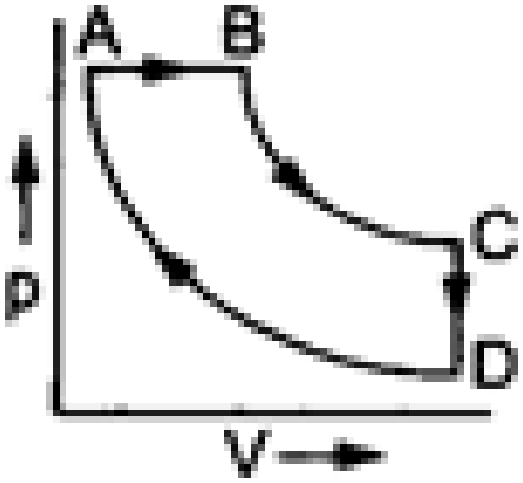
Q 14. A vertical cylinder of height 100 cm contains air at room temperature and its top is closed by a frictionless massless piston at atmospheric pressure (76 cm of mercury column). If mercury is slowly poured on the piston, due to extra weight air is compressed. Find the maximum height of Hg column which can be put on the piston

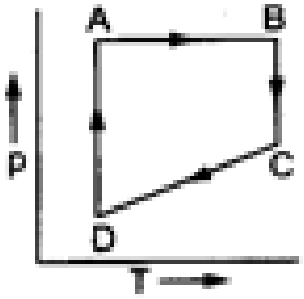


(a) 76
(b) 24
(c) 8
(d) 12

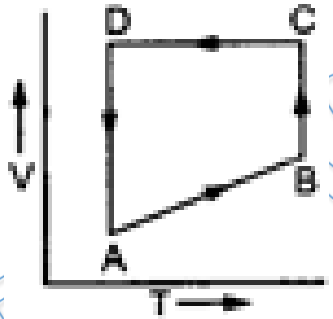
Q 15. A 20 cm long test tube (cylindrical) is inverted and pushed vertically down into water. When the closed end is at water surface, how high has the water risen inside the tube?
(a) 0.38 cm
(b) 10 cm
(c) 20 cm
(d) 15 cm

Q 16. A cyclic process ABCD is shown in the p-V diagram. Which of the following curves represent the same process? BC and AD has constant temperature

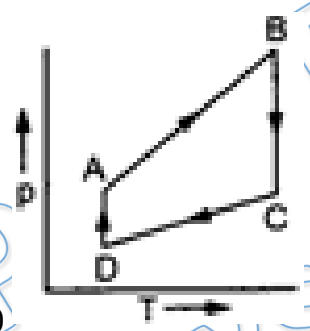




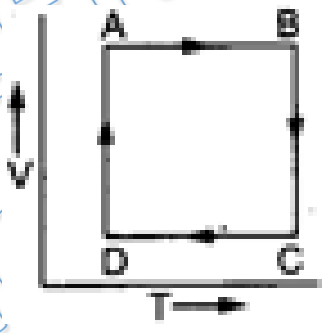
(a)



(b)



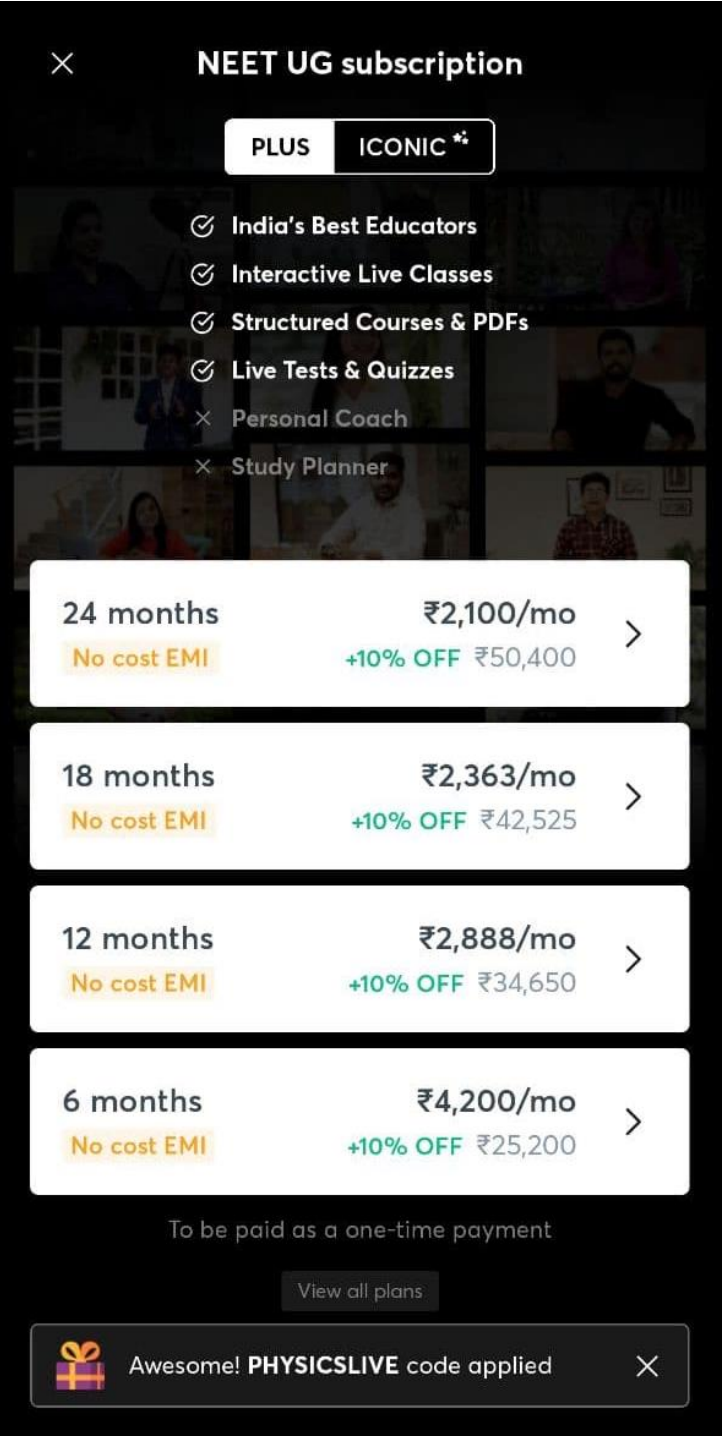
(c)



(d)

Answer Key

Q.1 b	Q.2 d	Q.3 a	Q.4 c	Q.5 b	
Q.6 c	Q.7 6	Q.8 a(p), b(q), c(s), d(s)		Q.9 2	Q.10 b
Q.11 a	Q.12 c	Q.13 c	Q.14 b	Q.15 a	
Q.16 a,b					



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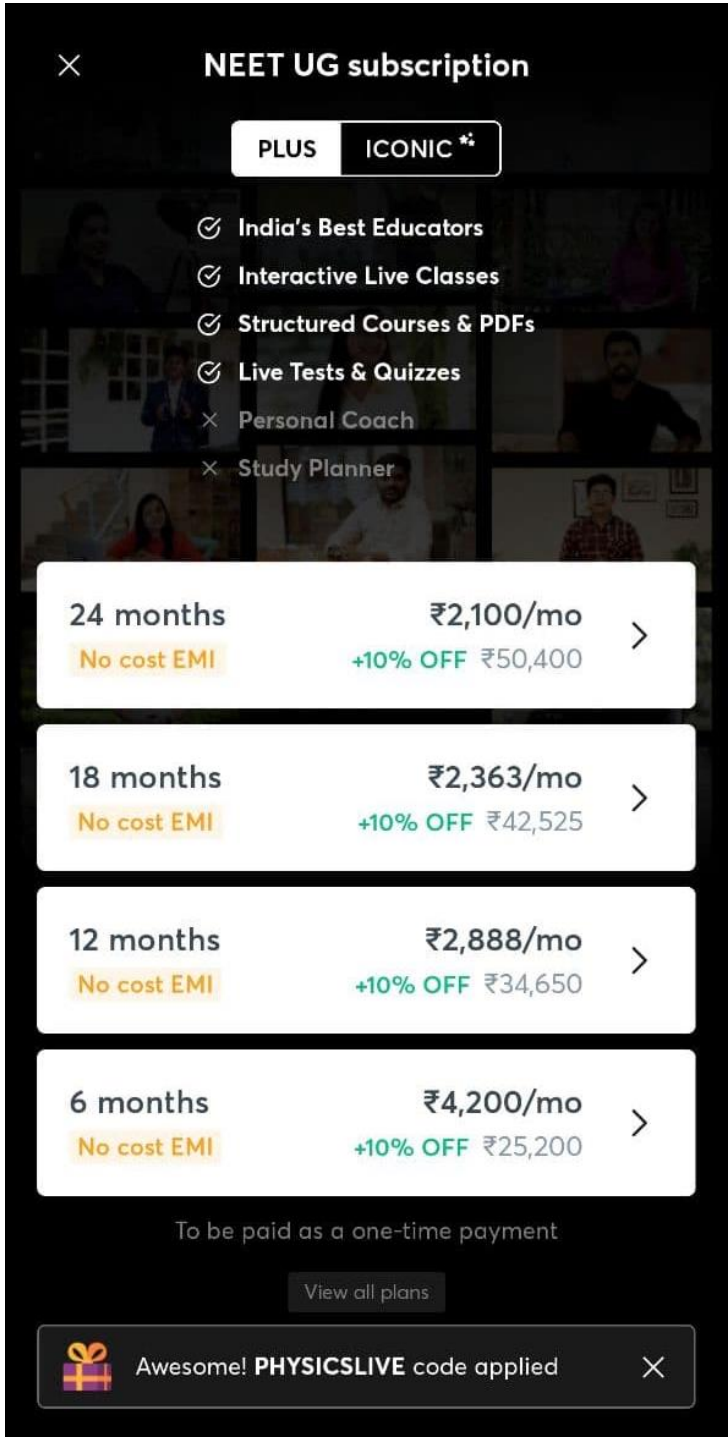


Written Solution

DPP- 1 KTG Postulates & Gaseous Laws

By Physicsaholics Team

Solution: 1

Attraction between gas molecules is negligible. Gravitational force acts b/w gas molecules but it is also negligible since mass of gas molecules is very small. molecules of gas have high velocity due to which they do not accumulate at bottom of container.

ANS(b)

Solution:2

According to kinetic theory option (a), (b) & (c) are true.

Therefore correct answer is (d).

Ans.d

Solution:3

Initial mass of gas = density x volume

$= 1.3 \times 30 = 39$ gram

mass of gas $\propto n \propto p$

$$\Rightarrow \frac{\text{Initial mass}}{\text{final mass}} = \frac{\text{Initial } p}{\text{final } p} = \frac{1}{.78}$$

$$\Rightarrow \text{final mass} = .78 \times 39 \text{ gram}$$

$= 30.4$ gram

ANS (a)

Solution:4

total no of moles $= \frac{7}{28} + \frac{11}{44} = 0.5$

$$V = \frac{nRT}{P} = \frac{1 \times 8.314 \times 290}{2 \times 10^5}$$

$$\rho = \frac{\text{mass}}{\text{volume}} = \frac{(7+11) \times 10^{-3} \times 2 \times 10^5}{8.314 \times 290}$$

$$= 1.5 \text{ kg/m}^3$$

Ans.c

Solution:5

Due to pseudoforce all molecules try to move rare side. due to which Pressure at front side will be lower.

Ans.b

Solution:6

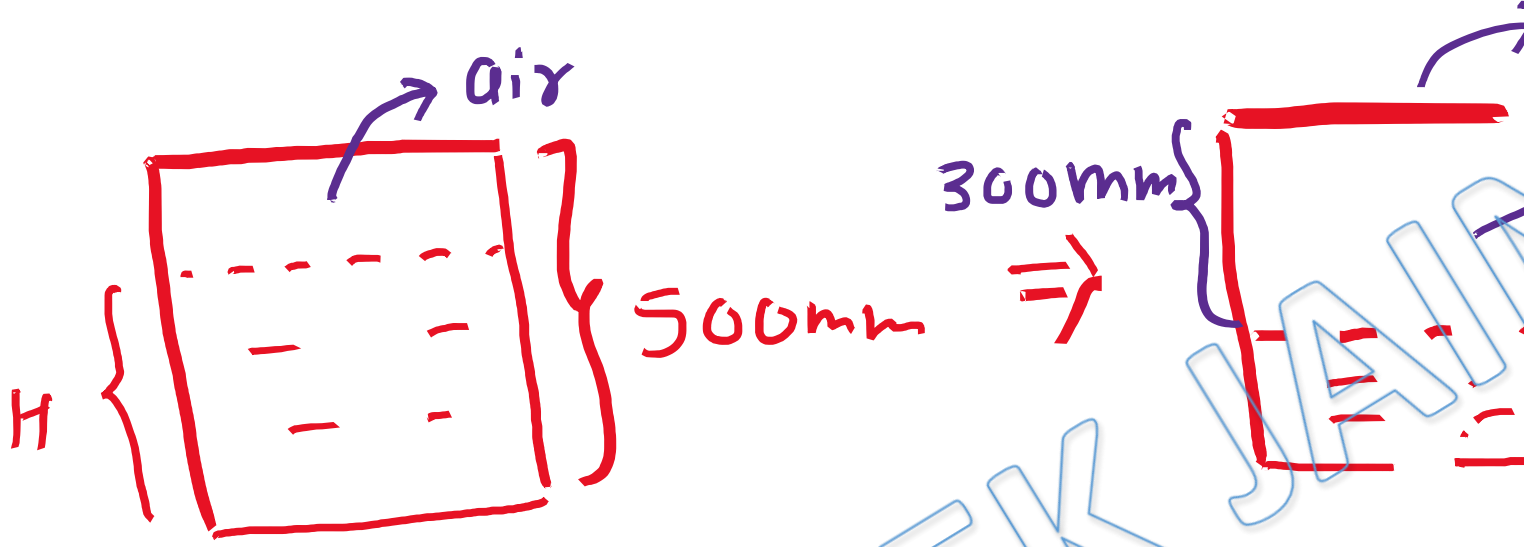
density of gas $\rho = \frac{PM}{RT}$

$$\frac{\rho_{tob}}{\rho_{both}} = \frac{(P/T)_{tob}}{(P/T)_{both}} = \frac{70 \times 300}{76 \times 280}$$

$$= .99$$

Ans. (c)

Solution: 7



$P = P_0 - \rho g h$

$= 10^5 - 10^3 \times 10 \times .2$

$= 98 \times 10^3$

for air above water surface $P_1 V_1 = P_2 V_2$

$\Rightarrow 1 \times 10^5 \times A(.5 - H) = 98 \times 10^3 \times A \times .3$

$\Rightarrow .5 - H = .98 \times .3 = .294$

$H = 206 \text{ mm}$

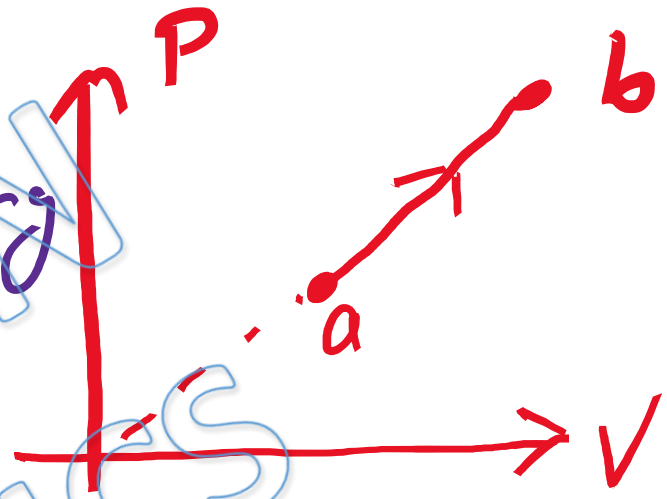
fall in height $= 206 - 200 = 6 \text{ mm}$

ANS (6)

Solution:8

Relation b/w P & V is

mistake, $P = mV$ & V is increasing



a) $T = \frac{PV}{nR} = \frac{mV^2}{nR}$ Ans(P)

b) density $\rho = \frac{\text{mass}}{V} \Rightarrow \rho$ is ↓ Ans(Q)

c) $V = \frac{nRT}{P} \Rightarrow V = \frac{nRT}{mV} \Rightarrow V^2 = \frac{nR}{m} T$

$\Rightarrow$ V-T graph is parabola Ans(S)

d) $P = \frac{nRT}{V} = \frac{nRT}{P/m} \Rightarrow P^2 = nmRT$

$\Rightarrow$ P-T graph is parabola Ans(R)

Solution:9

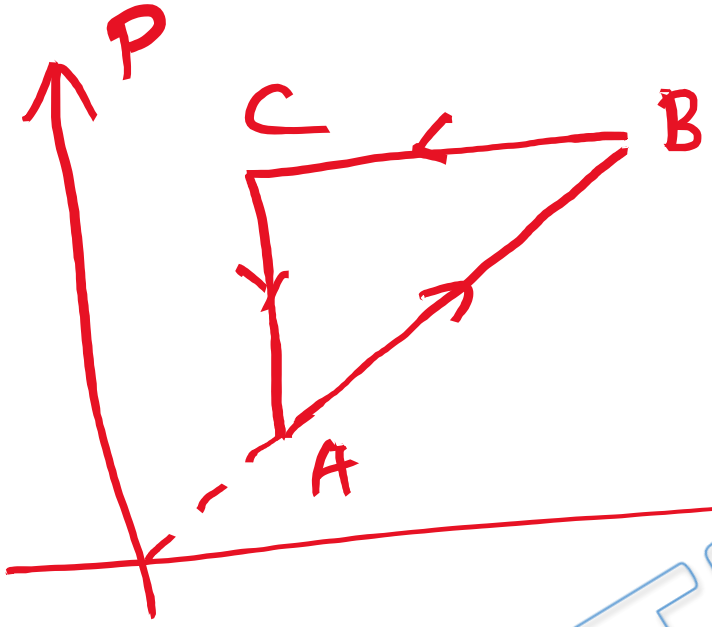
$$P = \frac{nRT}{V} \Rightarrow P \propto T$$

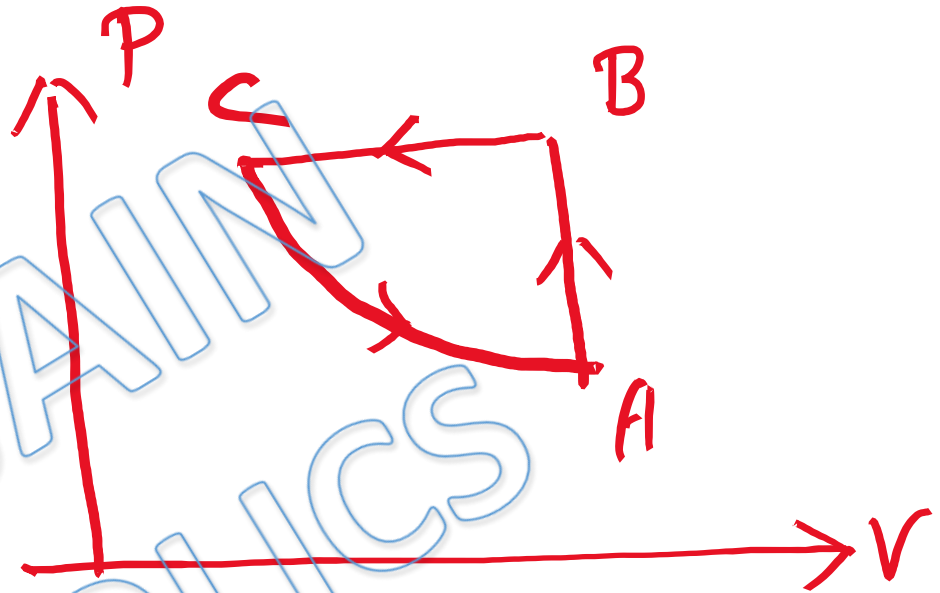
$\Rightarrow$ Pressure of Second vessel $= 2P$

$\Rightarrow x = 2$

ANS(2)

Solution:10





AB is Constant Volume → V is Constant & P is increasing

BC is Constant Pressure → P is Constant, T & V are decreasing

CA is Constant Temperature → T is Constant, PV graph is Rectangular Hyperbola

ANS(B)

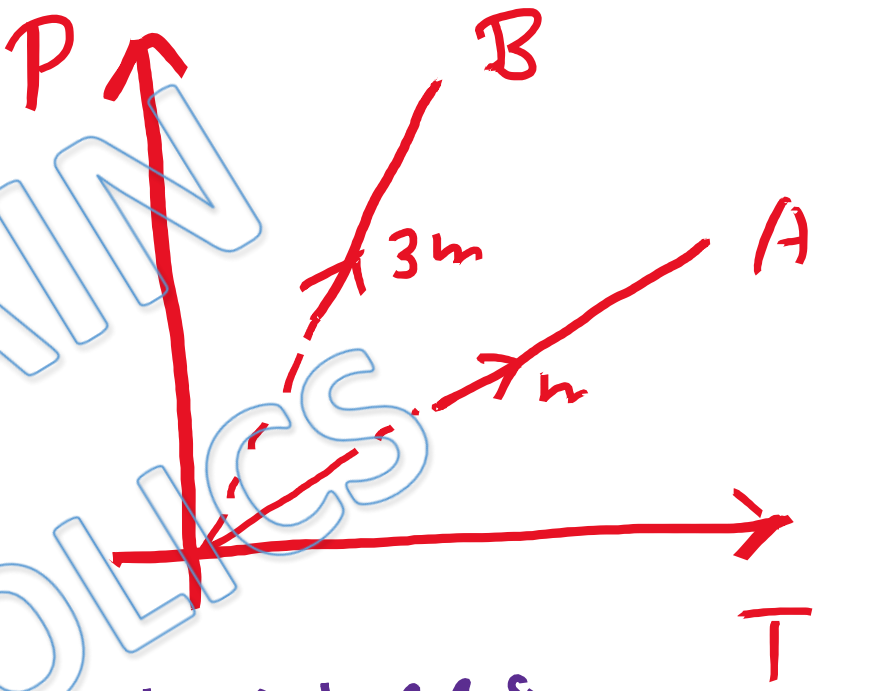
Solution:11

Slope of line

$$= \frac{P}{T} = \frac{nR}{V} = \frac{mR}{MT}$$

Slope $\propto m$

$$\frac{\text{Slope of B}}{\text{Slope of A}} = \frac{3m}{m} = 3$$



$m \rightarrow$ mass

$M \rightarrow$ Molar mass

ANS (a)

Solution: 12

Relation b/w V & T

$V = mT + C$

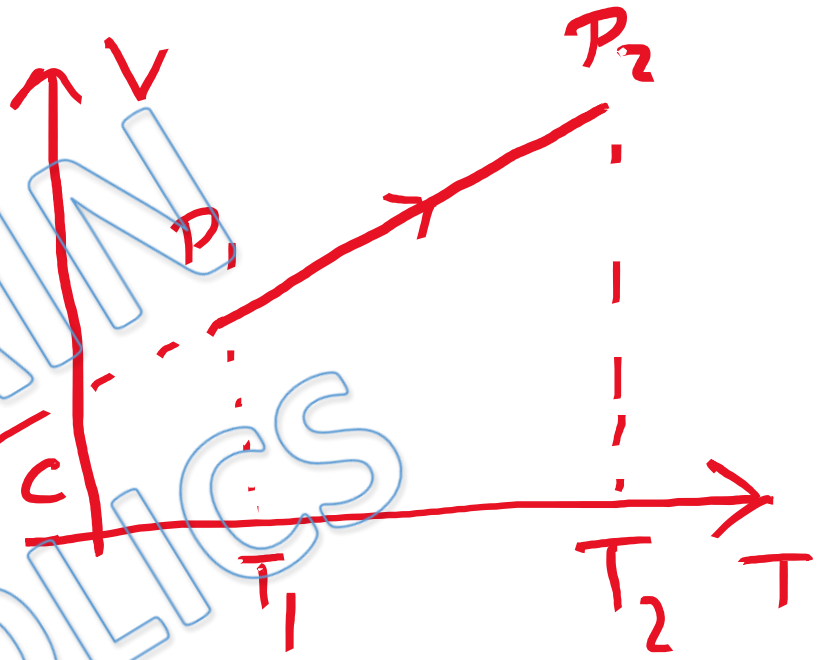
where m & C are +ve.

$$P = \frac{nRT}{V} = \frac{nRT}{mT + C}$$

$$P = \frac{nR}{m + \frac{C}{T}}$$

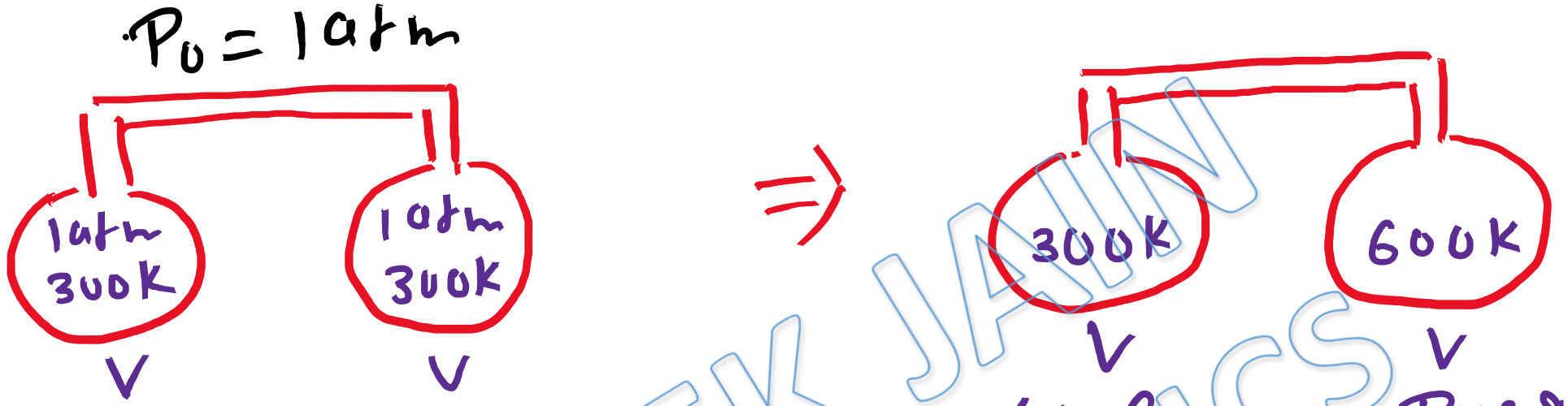
$\Rightarrow$ P will increase on increasing T

$\Rightarrow P_2 > P_1$



ANS (C)

Solution:13



Initial no of moles = final no of moles

$$\Rightarrow \frac{P_0 V}{R \times 300} \times 2 = \frac{PV}{R \times 300} + \frac{PV}{R \times 600}_2$$

$$2P_0 = \frac{3}{2} P$$

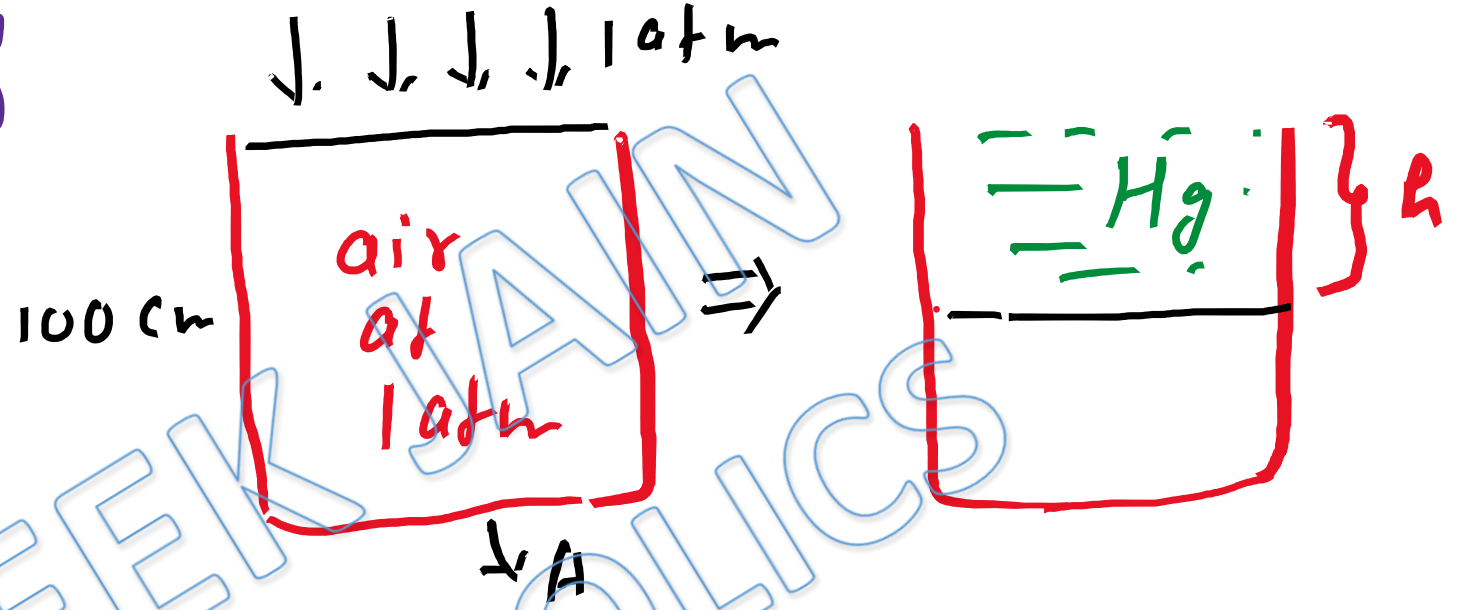
$$\Rightarrow P = \frac{4P_0}{3} = \frac{4}{3} \text{ atm}$$

ANS (c)

Solution:14

final Pressure of air in Container

$= (76 + h)$ cm of Hg



Using $P_1V_1 = P_2V_2$

$\Rightarrow$ (76 cm of Hg) $\times A \times 100$ cm $= [(76+h)$ cm of Hg$] \times A\,(100-h)$ cm

$\Rightarrow$

$$7600 = 7600 + 100h - 76h - h^2$$

$$h^2 = 24h$$

$$h = 24\text{ cm}$$

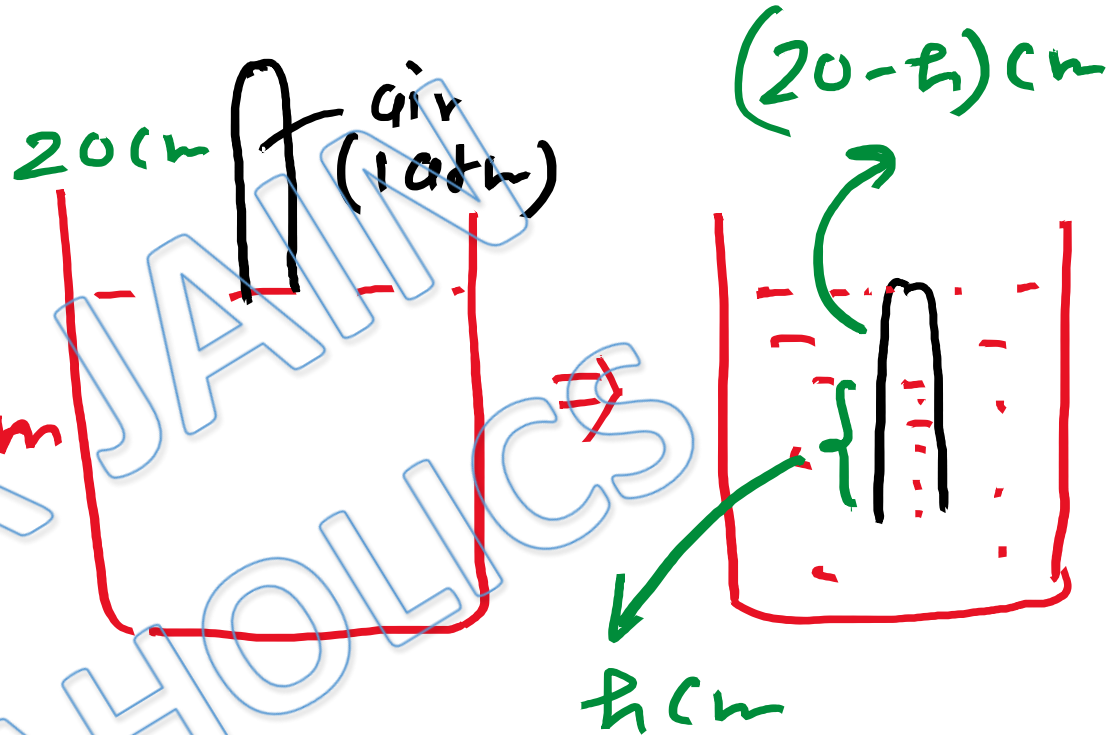
Ans (b)

Solution:15

Using $P_1V_1 = P_2V_2$

$\Rightarrow 10^5 \times A \times 20\,cm = P_2 \times A(20-h)cm$

$\Rightarrow P_2 = \dfrac{20 \times 10^5}{20-h}$



final pressure of air

$= P_0 + P_gH = 10^5 + 10^3 \times 10 \times \dfrac{(20-h)}{100} = \dfrac{20 \times 10^5}{(20-h)}$

$\Rightarrow 1000 + 20 - h = \dfrac{20000}{20-h}$

$\Rightarrow (1020 - h)(20 - h) = 20000$

we know that $h << 1020$

$\Rightarrow 20 - h = \frac{20000}{1020}$

$\Rightarrow 20 - h = 19.6\,cm$

$\Rightarrow h = .4\,cm$

Ans (a)

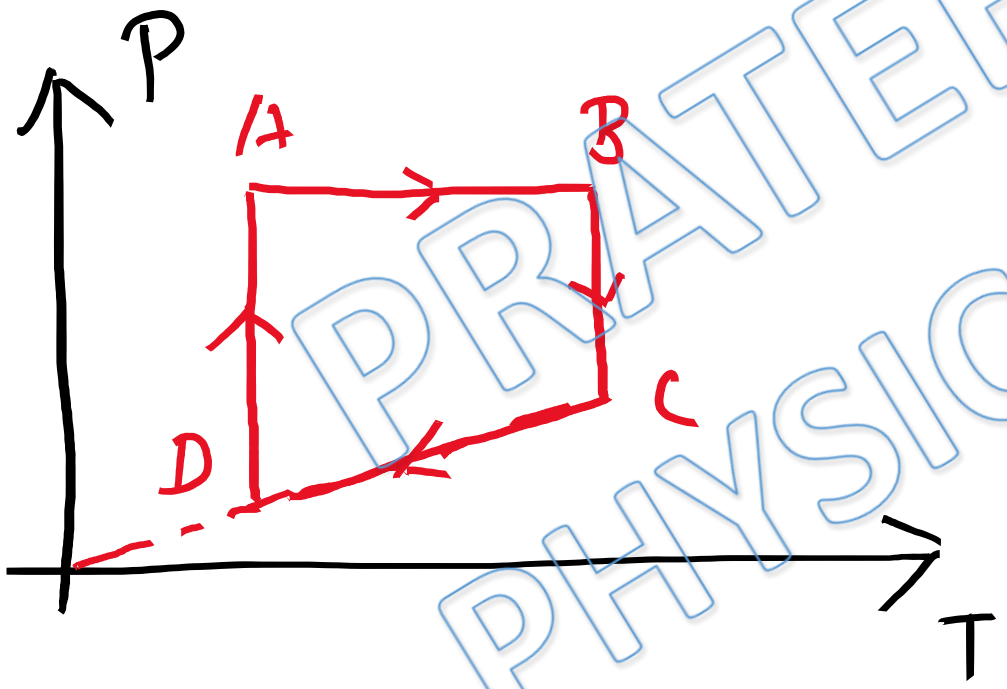
Solution: 16

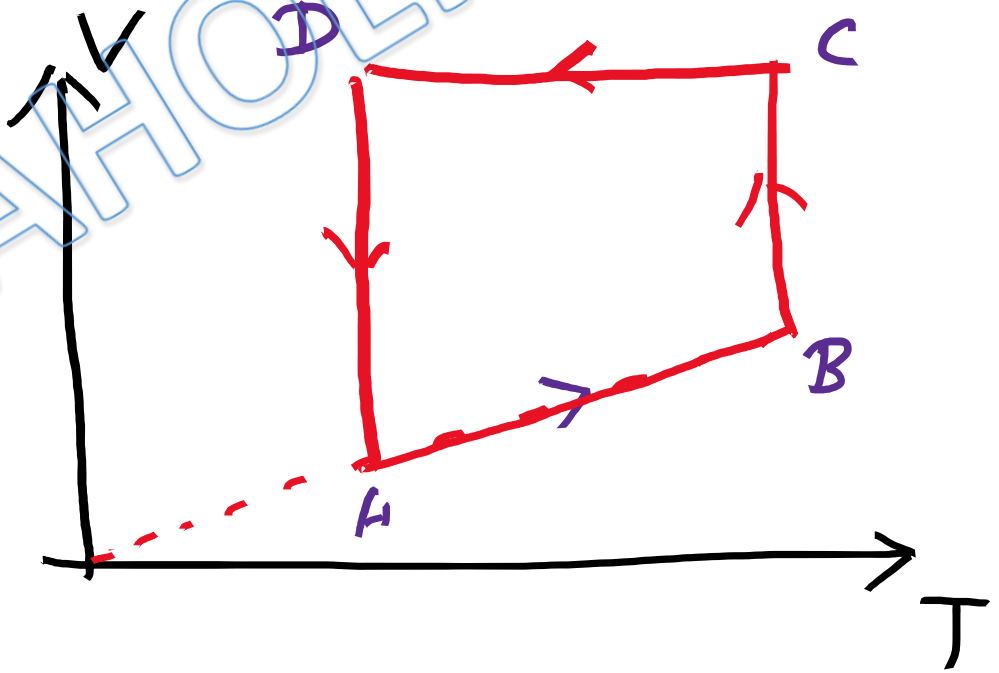
AB = Constant pressure

BC = Constant temperature

CD = Constant Volume

DA = Constant temperature





Ans.a,b

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