



## PHYSICS

### BOOKS - DC PANDEY PHYSICS (HINGLISH)

### THERMOMETRY THERMAL EXPANSION AND KINETIC THEORY OF GASES

#### Example

1. Express a temperature of  $60^{\circ} F$  in degrees Celsius and in kelvin.



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2. The temperature of an iron piece is heated from  $30^{\circ} C$  to  $90^{\circ} C$ . What is the change in its temperature on the fahrenheit scale and on the kelvin scale?





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3. On a new scale of temperature (which is linear) and called the  $W$  scale. The freezing and boiling points of water are  $39^\circ W$  and  $239^\circ W$  respectively. What will be the temperature on the new scale, corresponding to a temperature of  $39^\circ C$  on the Celsius scale?



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4. An arbitrary scale has the ice point at  $-20^\circ$  and the steam point at  $180^\circ$ . When the thermometer reads  $5^\circ$ , then find the read of centigrade thermometer.



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5. A faulty thermometer has its fixed points marked as  $5^\circ$  and  $95^\circ$ . The temperature of a body as measured by the faulty therature is  $59^\circ$ . Find the correct temperature of the body on Celsisus scale.



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6. The steam point and the ice point of a mercury thermometer are marked as  $80^\circ$  and  $10^\circ$ . At what temperature on centigrade scale the reading of this thermometer will be  $59^\circ$  ?



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7. The pressures of the gas filled in the bulb of a constant volume gas thermometer are 66 cm and 88 cm of mercury column at  $0^\circ C$  and  $100^\circ C$  respectively. When its bulb is immersed in a liquid placed in a vessel, its pressure is 82.5 cm of mercury column. Calculate the temperature of the liquid.



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8. The following observation were recorded on a platinum resistance thermometer. Resistance at melting point of pressure =  $4.71\Omega$ , and

resistance at  $t^{\circ}C = 2.29\Omega$ . Calculate

Temperature coefficient of resistants of platinum.

Value of temperature t.



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9. A steel ruler exactly  $20\text{cm}$  long is graduated to give correct measurements at  $20^{\circ}C$ .

(a) Will it give readings that are too long or too short at lower temperatures?

(b) What will be that actual length of the ruler when it is used in the desert at a temperature of  $40^{\circ}C$ ?  $\alpha_{steel} = 1.2 \times 10^{-5} ({}^{\circ}C)^{-1}$ .



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10. The length of a steel rod exceeds that of a brass rod by 5 cm. If the difference in their lengths remains same at all temperature, then the length of brass rod will be: ( $\alpha$  for iron and brass are  $12 \times 10^{-6} / {}^{\circ}C$  and  $18 \times 10^{-6} / {}^{\circ}C$ , respectively)





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11. A metal ball having a diameter of 0.4 m is heated from 273 to 360K. If the coefficient of areal expansion of the material of the ball is  $0.000034K^{-1}$ , then determine the increase in surface area of the ball.



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12. On heating a glass block of  $10,000cm^3$  from  $25^{\circ}C$  to  $40^{\circ}C$ , its volume increase by  $4cm^3$ . Calculate coefficient of linear expansion of glass.



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13. The volume of mercury in the bulb of thermometer is  $10^{-6}m^3$ . The area of cross-section of the capillary tube is  $2 \times 10^{-7}m^2$ . If the temperature is raised by  $100^{\circ}C$ , the increase in the length (in cm) of the mercury column is  $\left(\gamma_{Hg} = 18 \times 10^{-5}/^{\circ}C\right)$



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14. A clock which keeps correct time at  $20^{\circ}C$  is subjected to  $40^{\circ}C$ . If coefficient of linear expansion of the pendulum is  $12 \times 10^{-6} / ^{\circ}C$ . How much will it gain or loss in time ?



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15. A second's pendulum clock has a steel wire. The clock is calibrated at  $20^{\circ}C$ . How much time does the clock lose or gain in one week when the temperature is increased to  $30^{\circ}C$  ?  $\alpha_{steel} = 1.2 \times 10^{-5} (^{\circ}C)^{-1}$ .



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16. An aluminium cylinder 10 cm long. As a spacer between two steel walls. At  $12^{\circ}C$  it just slips in between the walls. When it warms to  $23^{\circ}C$  calculate the stress in the cylinder and the total force it exerts on each

wall, assuming that the walls are perfectly rigid and a constant distance apart.

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17. A non-conducting body floats in a liquid at  $25^{\circ}C$  with  $1/3$  of its volume immersed in the liquid. When liquid temperature is increased to  $105^{\circ}C$ ,  $1/2$  of body's volume is immersed in the liquid. Then, find the coefficient of real expansion of the liquid (neglecting the expansion of container of the liquid).

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18. The coefficient of apparent expansion of a liquid when determined using two different vessels A and B are  $\gamma_1$  and  $\gamma_2$ , respectively. If the coefficient of linear expansion of vessel A is  $\alpha$ . Find the coefficient of linear expansion of the vessel B.

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19. A glass vessel of volume  $V_0$  is completely filled with a liquid and its temperature is raised by  $\Delta T$ . What volume of the liquid will overflow ?  
Coefficient of linear expansion of glass =  $\alpha_g$  and coefficient of volume expansion of the liquid =  $\gamma_l$ .

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20. Assume that one early morning when the temperatures in  $10^\circ C$ , a driver of an automobile gets his gasoline tank which is made of steel, filled with 75 L of gasoline, which is also at  $10^\circ C$ . During the day, the temperature rises to  $30^\circ C$ , how much gasoline will overflow ?

(Given,  $\alpha$  for steel =  $1.2 \times 10^{-5} \text{ } ^\circ C^{-1}$ ,  $\gamma$  for gasoline =  $9.5 \times 10^{-4} \text{ } ^\circ C^{-1}$ )

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22. A sphere of diameter 7 cm and mass 265.5 gm floats in a bath of a liquid. As the temperature is raised, the sphere just begins to sink at a temperature of  $35^{\circ}C$ . If the density of a liquid at  $0^{\circ}C$  is 1.527 gm/cc, then neglecting the expansion of the sphere, the coefficient of cubical expansion of the liquid is



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23. The coefficient of volume expansion of glycerine is  $49 \times 10^{-5} / ^{\circ}C$ . What is the fractional change in its density (approx.) for  $30^{\circ}C$  rise in

temperature?

A.  $1.5 \times 10^{-2}$

B.  $2.5 \times 10^{-2}$

C.  $2.0 \times 10^{-2}$

D.  $2.8 \times 10^{-2}$

**Answer: A**



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**24.** If masses of all molecules of a gas are halved and the speed doubled.

Then the ratio of initial and final pressure is :



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**25.** Oxygen is filled in a closed metal jar of volume  $1.0 \times 10^{-3} m^3$  at a pressure of  $1.5 \times 10^5 Pa$ . and temperature  $400K$ . The jar has a small leak

in it. The atmospheric pressure is  $1.0 \times 10^5 Pa$  and the atmospheric temperature is  $300K$ . Find the mass of the gas that leaks out by time the pressure and the temperature inside the jar equalise with the surrounding.

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26. Find the coefficient of volume expansion of for an ideal gas at constant pressure.

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27. Find the average speed of nitrogen molecules at  $25^\circ C$ .

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28. In a container, two gases neon and argon are filled. Find the ratio of the root mean square of the molecules of the two gases.  $M_{Ne} = 20.0\mu$

and  $M_{Ar} = 39.9\mu$ . The temperature of the system is  $30^\circ C$ .

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29. What is rms velocity of  $O_2$  gas at  $127^\circ C$ . ? The molecular weight of oxygen is 32.

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30. Calculate the rms velocity of oxygen molecules at S.T.P. The molecular weight of oxygen is 32.

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31. The molecules of a given mass of a gas have root mean square speeds of  $100m.s^{-1}$  at  $27^\circ C$  and 1.00 atmospheric pressure. What will be the root mean square speeds of the molecules of the gas at  $127^\circ C$  and 2.0 atmospheric pressure?



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**32.** Calculate the root mean square, average and most probable speeds of oxygen molecules at  $27^{\circ}C$ .

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**33.** At what temperature, the kinetic energy of a gas molecule is half of the value at  $27^{\circ}C$ . ?

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**34.** Prove that the pressure of an ideal gas is numerically equal to two third of the mean translational kinetic energy per unit volume of the gas.

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**35.** A balloon has 5.0 g mole of helium at  $7^{\circ}C$  Calculate

- (a) the number of atoms of helium in the balloon,
- (b) the total internal energy of the system.



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**36.** A tank used for filling helium balloons has a volume of  $0.3m^3$  and contains (2.0) mol of helium gas at  $20.0^{\circ}C$ . Assuming that the helium behaves like an ideal gas.

- (a) What is the total translational kinetic energy of the molecules of the gas ?
- (b) What is the average kinetic energy per molecule ?



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**37.** Calculate the ratio of the mean free path of molecules of two gases if the ratio of the numbers density per  $cm^3$  of the gases is 5:3 and the ratio of the diameters of the molecules of the gases is 4:5



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**38.** For a molecule of an ideal gas  $n = 3 \times 10^8 \text{ cm}^{-3}$  and mean free path is  $10^{-2}$  cm. Calculate the diameter of the molecule.



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**39.** A gas at  $27^\circ \text{C}$  in a cylinder has a volume of 4 litre and pressure  $100 \text{ Nm}^{-2}$ .

(i) Gas is first compressed at constant temperature so that the pressure is  $150 \text{ Nm}^{-2}$ . Calculate the change in volume.

(ii) It is then heated at constant volume so that temperature becomes  $127^\circ \text{C}$ . Calculate the new pressure.



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**40.** The pressure of a given mass of a gas filled in a vessel of volume  $V$  at constant temperature is reduced to  $1/3$ rd of its initial value. Calculate the

percentage change in its volume.

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**41.** Air is filled in a container of  $333K$ . Calculate the temperature upto which it should be heated so that  $\frac{1}{3}$  rd of air may escape out of the vessel.

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**42.** The pressure of a gas filled in a closed container increases by  $1\%$  when temperature is increased by  $1^\circ C$ . Find the initial temperature of the gas.

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**43.** One mole each of hydrogen, oxygen and nitrogen are mixed in a close container of volume  $10\text{ L}$  and temperature  $27^\circ C$ . Calculate the pressure

exercated by the mixture. ( $R = .314Jmol^{-1}K^{-1}$ )

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**44.** 4g hydrogen is mixed with 11.2 litre of He at (STP) in a container of volume 20 litre. If the final temperature is 300K, find the pressure.

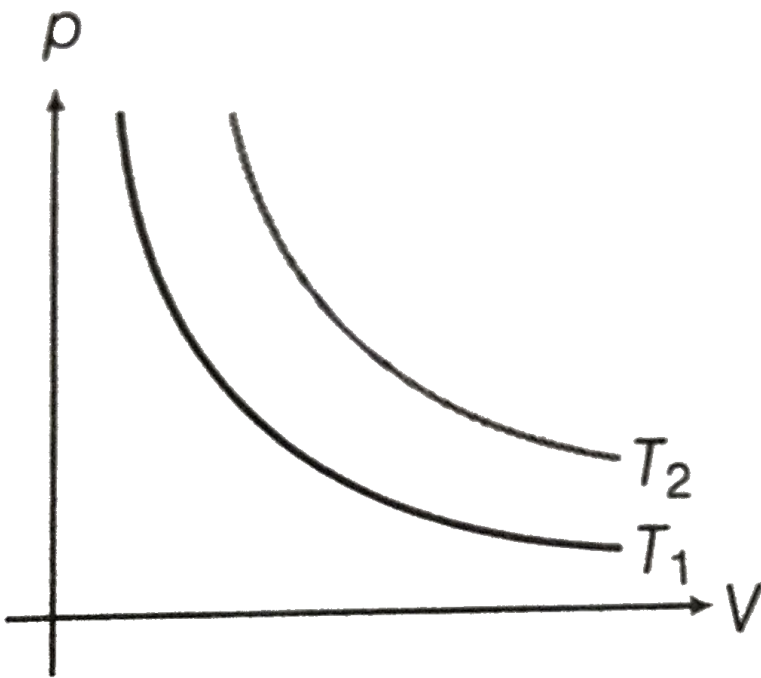
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**45.** If pressure of  $CO_2$  (real gas ) in a container is given by

$$P = \frac{RT}{2V - b} - \frac{a}{4b^2}, \text{ then mass of the gas in container is}$$

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**46.** The  $p - V$  diagrams of same mass of a gas are drawn at two different temperatues  $T_1$  and  $T_2$  Explain whether  $T_1 > T_2 >$  or  $T_2 > T_1$ .

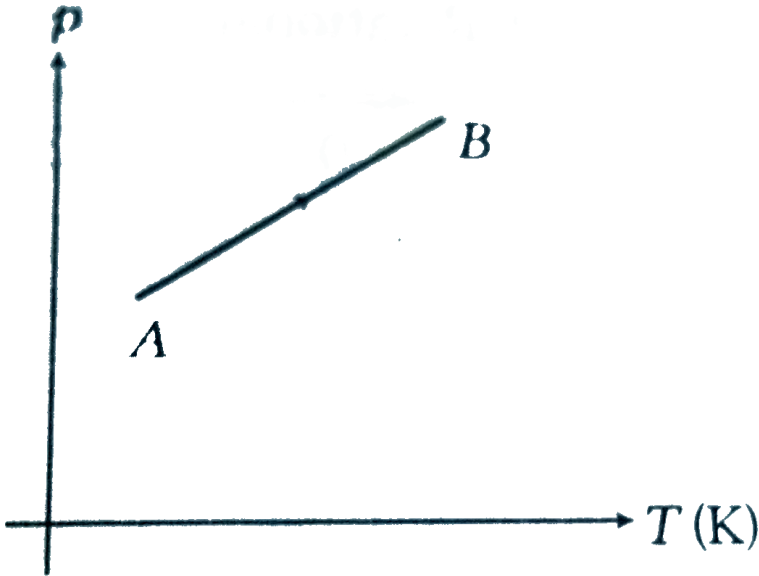


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47. The  $p - V$  diagram of two different masses  $m_1$  and  $m_2$  are drawn (as shown) at constant temperature ( $T$ ). State whether  $m_1 > m_2$  or  $m_2 > m_1$ . (DCP\_V03\_C20\_S01\_009\_Q01).

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48. The  $p - T$  graph for the given mass of an ideal gas is shown in figure. What inference can be drawn regarding the change in Volume (whether it is constant, increasing or decreasing) ?



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49. Calculate the ratio of KE of molecule of oxygen and neon gas at  $27^\circ C$ .

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50. Calculate the average kinetic energy of oxygen molecule at  $0^{\circ}\text{C}$ .

( $R=8.314 \text{ J mol}^{-1} \text{ K}^{-1}$ ,  $N_A=6.02 \times 10^{23}$ )

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51. Find the average kinetic energy per molecule at temperature  $T$  for an equimolar mixture of two ideal gases A and B, where A is monoatomic and B is diatomic.

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52. Calculate the change in internal energy of 3.0 mol of helium gas when its temperature is increased by  $2.0 \text{ K}$ .

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53. Given, Avogadro's number  $N = 6.02 \times 10^{23}$  and Boltzmann's constant  $k = 1.38 \times 10^{-23} \text{ J/K}$ .

(a) Calculate the average kinetic energy of translation of the molecules of an ideal gas at  $0^\circ \text{C}$  and *at*  $100^\circ \text{C}$ .

(b) Also calculate the corresponding energies per mole of the gas.



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54. One mole of an ideal monoatomic gas is taken at a temperature of  $300\text{K}$ . Its volume is doubled keeping its pressure constant. Find the change in internal energy.



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### Check Point 14 1

1. A device used to measure very high temperature is

- A. Hygrometer
- B. Thermomefer
- C. Barometer
- D. Calorimeter

**Answer: B**

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2. On which of the following scales of temperature, the temperature is never negative

- A. Celsius
- B. Fahrenheit
- C. Reaumur
- D. Calorimeter

**Answer: D**

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3. A difference of temperature of  $25^{\circ}C$  is equivalent to a difference of

A.  $45^{\circ}F$

B.  $72^{\circ}F$

C.  $32^{\circ}F$

D.  $25^{\circ}F$

**Answer: A**

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4. The absolute zero temperature in Fahrenheit scale is

A.  $-273^{\circ}F$

B.  $-32^{\circ}F$

C.  $-460^{\circ}F$

D.  $-132^{\circ}F$

**Answer: C**



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5. The freezing point on a thermometer is marked as  $-20^{\circ}$  and the boiling point as  $130^{\circ}$ . A temperature of human body ( $34^{\circ}C$ ) on this thermometer will be read as

A.  $31^{\circ}$

B.  $51^{\circ}$

C.  $20^{\circ}$

D. None of these

**Answer: A**



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6. At what temperature the Fahrenheit and Celsius scales of temperature give the same reading ?.

A.  $-40^{\circ}$

B.  $40^{\circ}$

C.  $36.6^{\circ}$

D.  $38^{\circ}$

**Answer: A**



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7. A faulty thermometer has its fixed points marded 5 and 95. if the temperature of a body as shown on the Celsius scale is 40, then its temperature shown on this faulty thermometer is

A.  $39^{\circ}$

B.  $40^{\circ}$

C.  $41^\circ$

D.  $44.4^\circ$

**Answer: C**



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8. The temperature of a body on Kelvin scale is found to be  $x$  K . When it is measured by Fahrenheit thermometer, it is found to be  $x^\circ F$  , then the value of  $x$  is

A. 40

B. 313

C. 574.25

D. 301.25

**Answer: C**



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9. The readings of a thermometer at  $0^{\circ}C$  and  $100^{\circ}C$  are  $50cm$  and  $75cm$  of mercury column respectively. Find the temperature at which its reading is  $80cm$  of mercury column ?

A.  $105^{\circ}C$

B.  $110^{\circ}C$

C.  $115^{\circ}C$

D.  $120^{\circ}C$

**Answer: D**



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10. The readings of a bath on Celsius and Fahrenheit thermometers are in the ratio 2 :5. The temperature of the bath is

A.  $-26.66^{\circ}C$

B.  $40^{\circ}C$

C.  $45.71^{\circ}C$

D.  $26.66^{\circ}C$

**Answer: C**



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## Check Point 14 2

1. A solid metal ball has a spherical cavity. If the ball is heated, the volume of the cavity will

A. increase

B. decreases

C. remain unchanged

D. Data insufficient



**Answer: A**



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2. The ratio among coefficient of volume expansion, superficial expansion and linear expansion i.e.,

$\gamma : \beta : \alpha$  is

- A. 1 : 2 : 3
- B. 3 : 2 : 1
- C. 4 : 3 : 2
- D. All of these

**Answer: B**



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3. Bimetal strips are used for

- A. metal thermometer
- B. opening or closing electrical circuits
- C. thermomats
- D. All of the above

**Answer: D**

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4. The temperature of a physical pendulum, whose time period is  $T$ , is raised by  $\Delta\theta$ . The change in its time period is

A.  $\frac{1}{2}\alpha\Delta\theta$

B.  $2\alpha T\Delta\theta$

C.  $\frac{1}{2}\alpha\Delta\theta$

D.  $2\alpha\Delta\theta$

**Answer: A**

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5. On heating a liquid having coefficient of volume expansion  $\alpha$  in a container having coefficient of linear expansion  $\alpha/2$ , the level of the liquid in the container would

- A. rise
- B. fall
- C. remains almost stationary
- D. Cannot be predicted

**Answer: B**

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6. ABCD is thin iron sheet. A hole with radius  $r$  is made in it in the middle. If we heat up the sheet, what will happen to the hole.

- A. Radius will increase
- B. Radius will decreases
- C. It will remains constant
- D. It can increase or decrease depending upn size

**Answer: A**

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7. A beaker is completely filled with water at  $4^{\circ}C$ . It will overflow if

- A. heated above  $4^{\circ}C$
- B. cooled below  $4^{\circ}C$
- C. both heated and cooled above and below  $4^{\circ}C$  respectively
- D. None of the above

**Answer: C**

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8. A bar of iron is 10 cm at  $20^{\circ}C$ . At  $19^{\circ}C$  it will be ( $\alpha$  of iron  $= 11 \times 10^{-6} / ^{\circ}C$ )

- A.  $11 \times 10^{-6}$  cm longer
- B.  $11 \times 10^{-6}$  cm shorter
- C.  $11 \times 10^{-5}$  cm shorter
- D.  $11 \times 10^{-5}$  cm longer

**Answer: C**



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9. A steel tape gives correct measurement at  $20^{\circ}C$ . A piece of wood is being measured with the steel tape at  $0^{\circ}C$ . The reading is 25 cm on the tape. The real length of the given piece of wood must be

- A. 25 cm

B.  $> 25\text{cm}$

C.  $< 25\text{cm}$

D. can not say

**Answer: B**



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10. Two rods of length  $l_1$  and  $l_2$  are made of material whose coefficient of linear expansion are  $\alpha_1$  and  $\alpha_2$ , respectively. The difference between their lengths will be independent of temperature if  $l_1/l_2$  is to

A.  $\frac{l_1}{l_2} = \frac{\alpha_1}{\alpha_2}$

B.  $\frac{l_1}{l_2} = \frac{\alpha_2}{\alpha_1}$

C.  $l_2^2 \alpha_1 = l_1^2 \alpha_2$

D.  $\frac{\alpha_1^2}{l_1} = \frac{\alpha_2^2}{l_2}$

**Answer: B**

11. The radius of a ring is  $R$  and its coefficient of linear expansion is  $\alpha$ . If the temperature of ring increases by  $\theta$  then its circumference will increase by

A.  $\pi R\alpha\theta$

B.  $2\pi R\alpha\theta$

C.  $\pi R\alpha \frac{\theta}{2}$

D.  $\pi R\alpha \frac{\theta}{4}$

**Answer: B**

12. If two rods of length  $L$  and  $2L$  having coefficients of linear expansion  $\alpha$  and  $2\alpha$  respectively are connected so that total length becomes  $3L$ , the average coefficient of linear expansion of the composite rod equals

A.  $\frac{2}{3}\alpha$

B.  $\frac{5}{2}\alpha$

C.  $\frac{5}{3}\alpha$

D. None of these

**Answer: C**

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**13.** A metal rod of silver at  $0^{\circ}C$  is heated to  $100^{\circ}C$ . Its length is increased by  $0.19cm$ . Coefficient of cubical expansion of the silver rod is

A.  $5.7 \times 10^{-5} / ^{\circ}C$

B.  $0.63 \times 10^{-5} / ^{\circ}C$

C.  $1.9 \times 10^{-5} / ^{\circ}C$

D.  $16.1 \times 10^{-5} / ^{\circ}C$

**Answer: A**



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14. A uniform metal rod is used as a bar pendulum. If the room temperature rises by  $10^\circ C$ , and the coefficient of linear expansion of the metal of the rod is  $2 \times 10^{-6}$  per  $^\circ C$ , the period of the pendulum will have percentage increase of

A.  $-2 \times 10^{-3}$

B.  $-1 \times 10^{-3}$

C.  $2 \times 10^{-3}$

D.  $1 \times 10^{-3}$

**Answer: D**

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15. Two rods of different materials having coefficient of thermal expansion  $\alpha_1, \alpha_2$  and young's moduli  $Y_1, Y_2$  respectively are fixed between two rigid

massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of rods. If  $\alpha_1 : \alpha_2 = 2 : 3$ , the thermal stresses developed in the two rods are equal provided  $Y_1 : Y_2$  is equal to

- A. 2 : 3
- B. 1 : 1
- C. 3 : 2
- D. 4 : 9

**Answer: C**



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**16.** Coefficient of volume expansion of mercury is  $0.18 \times 10^{-3} / .^{\circ} C$ . If the density of mercury at  $0^{\circ} C$  is 13.6g/cc, then its density at  $200^{\circ} C$  is

- A. 13.11 g/cc
- B. 52.11 g/cc

C. 16.11 g/cc

D. 26.11 g/cc

**Answer: A**



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17. A glass flask of volume  $200\text{cm}^3$  is just filled with mercury at  $20^\circ\text{C}$ . The amount of mercury that will overflow when the temperature of the system is raised to  $100^\circ\text{C}$  is

$$(\gamma_{\text{glass}} = 1.2 \times 10^{-5} / \text{C}^\circ, \gamma_{\text{mercury}} = 1.8 \times 10^{-4} / \text{C}^\circ)$$

A.  $2.15\text{ cm}^3$

B.  $2.69\text{ cm}^3$

C.  $2.52\text{ cm}^3$

D.  $2.25\text{ cm}^3$

**Answer: B**



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18. Solids expand on heating because

- A. kinetic energy of atom increases
- B. Potential energy of atom increases
- C. Total energy of atom increases
- D. The potential energy curve is asymmetric about the equilibrium distance between neighbouring atoms

**Answer: D**



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19. The coefficient of linear expansion of crystal in one direction is  $\alpha_1$  and that in every direction perpendicular to it is  $\alpha_2$ . The coefficient of cubical expansion is

A.  $\alpha_1 + \alpha_2$

B.  $2\alpha_1 + \alpha_2$

C.  $\alpha_1 + 2\alpha_2$

D. None of these

**Answer: C**

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**20.** A steel rod of diameter 1 cm is clamped firmly at each end when its temperature is  $25^\circ C$  so that it cannot contract on cooling. The tension in the rod at  $0^\circ C$  is approximately

$(\alpha = 10^{-5} / ^\circ C, Y = 2 \times 10^{11} Nm^{-2})$

A. 4000 N

B. 7000 N

C. 7400 N

D. 4700 N

**Answer: A**

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### Check Point 14.3

1. Which one of the following is not an assumption in the kinetic theory of gases?

- A. The volume occupied by the molecules of the gas is negligible
- B. The force of attraction between the molecules is negligible
- C. The collision between molecules are elastic
- D. All molecules have same speed

**Answer: D**

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2. A closed vessel is maintained at a constant temperature. It is first evacuated and then vapour is injected it continuously. The pressure of the vapour in the vessel

- A. increases continuously
- B. first increases and then remains constant
- C. first increase and then remains constant
- D. None of above

**Answer: C**



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3. The average speed of molecules in a gas is given by

A.  $\sqrt{\frac{3p}{p}}$

B.  $\sqrt{\frac{\gamma p}{p}}$

C.  $\sqrt{\frac{2p}{p}}$

D.  $\sqrt{\frac{8p}{\pi\rho}}$

**Answer: B**

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4. For gas at a temperature  $T$  the root-mean-square speed  $v_{rms}$ , the most probable speed  $v_{mp}$ , and the average speed  $v_{av}$  obey the relationship

A.  $v < v_p < v_{rms}$

B.  $v < v_{rms} < v_p$

C.  $v_p < v < v_{rms}$

D.  $v_p < v_{rms} < v$

**Answer: C**

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5. The average kinetic energy of a gas molecule is

- A. proportional to pressure of gas
- B. inversely proportional to volume of gas
- C. inversely proportional to absolute temperature of gas
- D. directly proportional to absolute temperature of gas

**Answer: D**



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6. KE per unit volume is  $E$ . The pressure exerted by the gas is given by

A.  $\frac{E}{3}$

B.  $\frac{2E}{2}$

C.  $\frac{3E}{2}$

D.  $\frac{E}{2}$

**Answer: B**



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7. If at the same temperature and pressure, the densities of two diatomic gases are  $d_1$  and  $d_2$  respectively. The ratio of mean kinetic energy per molecule of gases will be

A. 1 : 1

B.  $d_1 : d_2$

C.  $\sqrt{d_1} : \sqrt{d_2}$

D.  $\sqrt{d_2} : \sqrt{d_1}$

**Answer: A**



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8. Two vessels A and B having equal volume contain equal masses of hydrogen in A and helium in B at 300 K. Then, mark the correct statement?

- A. The pressure exerted by hydrogen is half that exerted by helium
- B. The pressure exerted by hydrogen is equal to that exerted by helium
- C. Average KE of the molecule of hydrogen is half the average KE of the molecules of helium
- D. The pressure exerted by hydrogen is twice that exerted by helium

**Answer: D**



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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 temperature  $2T$  has a pressure of

A.  $p/8$

B.  $p$

C.  $2p$

D.  $8p$

**Answer: C**



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10. What will be the temperature when the rms velocity is double of that at 300 K?

A. 300 K

B. 600 K

C. 900 K

D. 1200 K

**Answer: D**



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**11.** By what factor the rms velocity will change, if the temperature is raised from  $27^{\circ}C$  to  $327^{\circ}C$ ?

A.  $\sqrt{2}$

B. 2

C.  $\sqrt{2}$

D. 1

**Answer: A**



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**12.** The velocities of three molecules are  $3v$ ,  $4v$  and  $5v$ . Calculate their root mean square velocity.

A.  $\sqrt{\frac{52}{3}}v$

B.  $\sqrt{(5)/(2)}v$

C.  $\frac{7}{2}v$

D.  $\frac{5}{2}v$

**Answer: A**



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**13.** The temperature at which the root mean squares speed of a gas will be half its value at  $0^\circ C$  is (assume the pressure remains constant)

A.  $-86.4^\circ C$

B.  $-204.75^\circ C$

C.  $-104.75^\circ C$

D.  $-6825^\circ C$

**Answer: A**

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14. Four molecules of gas have speeds 1, 2, 3 and 4  $km/s$ . The value of the root mean square speed of the gas molecules is

A.  $\frac{1}{2}\sqrt{15}km/s^{-1}$

B.  $\frac{1}{2}\sqrt{10}km/s^{-1}$

C.  $2.5km/s^{-1}$

D.  $\sqrt{15/2}km/s^{-1}$

**Answer: D**

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15. A sealed container with negligible coefficient of volumetric expansion contains helium (a monatomic gas). When it is heated from 300 K to 600 K, the average KE of helium atoms is

- A. halved
- B. unchanged
- C. doubled
- D. increased by factor  $\sqrt{2}$

**Answer: C**

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**16.** The gases carbon-monoxide (CO) and nitrogen at the same temperature have kinetic energies  $E_1$  and  $E_2$  respectively. Then

- A.  $E_1 = E_2$
- B.  $E_1 > E_2$
- C.  $E_1 < E_2$
- D. None of these

**Answer: A**



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17. Pressure of an ideal gas is increased by keeping temperature constant. What is its effect on kinetic energy of molecules?

- A. Increases
- B. decreases
- C. No change
- D. Cannot be determined

**Answer: C**

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18. Some gas at 300K is enclosed in a container. Now the container is placed on a fast moving train. While the train is in motion, the temperature of the gas

- A. rises above 300 K
- B. falls below 300 K
- C. remains unchanged
- D. becomes unsteady

**Answer: C**

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**19.** The root-mean-square (rms) speed of oxygen molecules ( $O_2$ ) at a certain absolute temperature is  $v$ . If the temperature is double and the oxygen gas dissociated into atomic oxygen, the rms speed would be

- A.  $v$
- B.  $\sqrt{2}v$
- C.  $2v$
- D.  $2\sqrt{2}v$

**Answer: C**



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20. The molecules of a given mass of a gas have rms velocity of  $200 \text{ m/s}$  at  $27^\circ \text{C}$  and  $1.0 \times 10^5 \text{ N/m}^2$  pressure. When the temperature and pressure of the gas are respectively  $127^\circ \text{C}$  and  $0.05 \times 10^5 \text{ Nm}^{-2}$ , the rms velocity of its molecules in  $\text{ms}^{-1}$  is

A.  $200 \text{ms}^{-1}$

B.  $400 \text{ms}^{-1}$

C.  $200\sqrt{2} \text{ms}^{-1}$

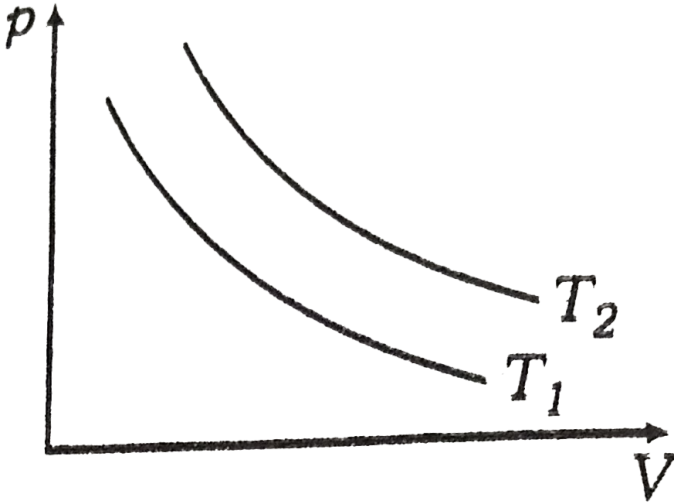
D.  $400\sqrt{2} \text{ms}^{-1}$

**Answer: C**



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1. The adjoining figure shows graph of pressure and volume of a gas at two temperatures  $T_1$  and  $T_2$  Which one the following is correct



- A.  $T_1 > T_2$
- B.  $T_1 = T_2$
- C.  $T_1 < T_2$
- D. Nothing can be said about temperatures

**Answer: C**



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2. In a gas equation,  $PV = RT$ ,  $V$  refers to the volume of

- A. any amount of gas
- B. one gram of gas
- C. one gram mole of gas
- D. one litre of the gas

**Answer: C**



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3. What is the degree of freedom in case of a monoatomic gas?

- A. 1
- B. 3
- C. 5

D. None of these

**Answer: B**



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4. Calculate the total number of degree of freedom for a mole of diatomic gas at STP.

A. 2

B. 3

C. 5

D. 6

**Answer: B**



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5. The degrees of freedom of a molecule of a non-linear triatomic gas is (ignore vibrational motion)

A. 2

B. 4

C. 6

D. 8

**Answer: C**



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6. The mean kinetic energy of one mole of gas per degree of

A.  $\frac{1}{2}kT$

B.  $\frac{3}{2}kT$

C.  $\frac{3}{2}RT$

D.  $\frac{1}{2}RT$

**Answer: D**



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7. The average translational kinetic energy of  $O_2$  (molar mass 32) molecules at a particular temperature is  $0.048eV$ . The translational kinetic energy of  $N_2$  (molar mass 28) molecules in (eV) at the same temperature is (JEE 1997)

(a) 0.0015 (b) 0.003 (c) 0.048 (d) 0.768

A. 0.0015

B. 0.003

C. 0.048

D. 0.768

**Answer: C**



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8. A perfect gas at  $27^{\circ}C$  is heated at constant pressure so as to triple its volume. The temperature of the gas will be

- A.  $84^{\circ}C$
- B.  $900^{\circ}C$
- C.  $627^{\circ}C$
- D.  $450^{\circ}C$

**Answer: C**



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9. 16 gram of oxygen, 14 gram of nitrogen and 11 gram of carbon dioxide are mixed in an enclosure of volume 5 L and temperature  $27^{\circ}C$ . The pressure exerted by the mixture is

- A.  $4 \times 10^5 Nm^{-2}$
- B.  $5 \times 10^5 Nm^{-2}$

C.  $6 \times 10^5 Nm^{-2}$

D.  $9 \times 10^5 Nm^{-2}$

**Answer: C**



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10. A balloon is filled at  $27^\circ C$  and 1 atm pressure by  $500m^3$  He. At  $-3^\circ C$  and 0.5 atm pressures, the volume of He-gas contained in balloon will be

A.  $700 m^3$

B.  $900 m^3$

C.  $1000 m^3$

D.  $500 m^3$

**Answer: B**



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11. A perfect gas at  $27^\circ C$  is heated at constant pressure so as to double its volume. The increase in temperature of the gas will be

A.  $600^\circ C$

B.  $327^\circ C$

C.  $54^\circ C$

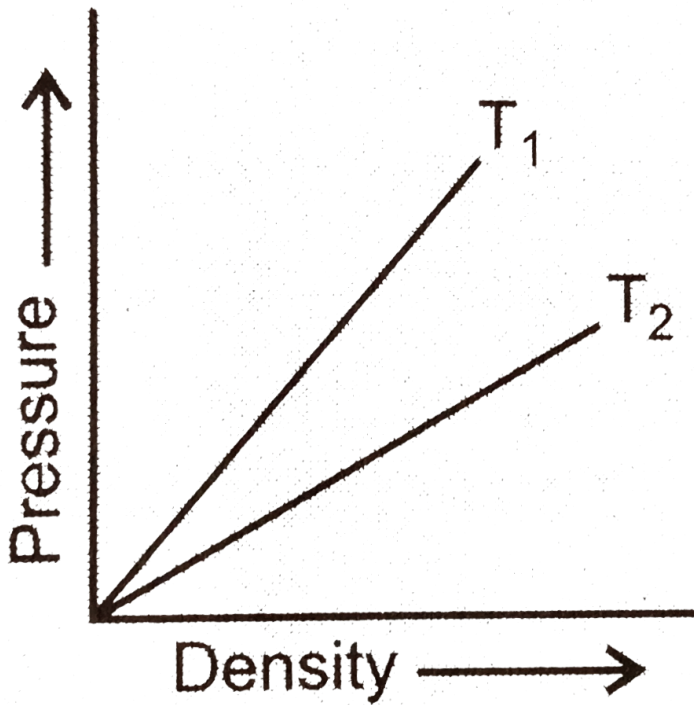
D.  $300^\circ C$

**Answer: D**



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12. Figure shows graphs of pressure versus density for an ideal gas at two temperatures  $T_1$  and  $T_2$ . Which is correct?



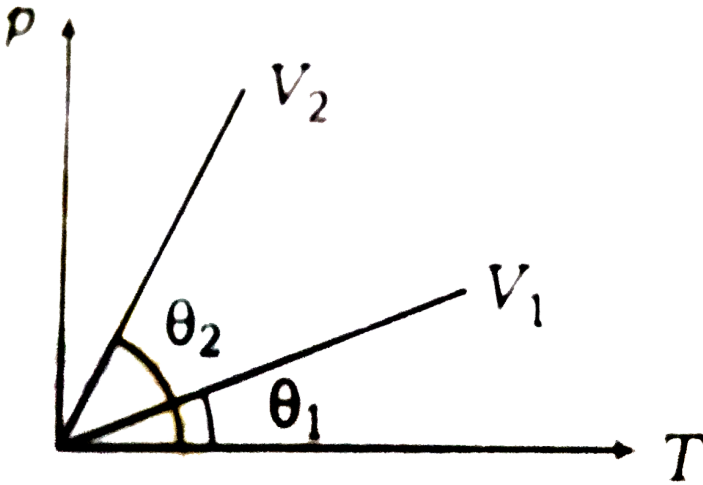
- A.  $T_1 > T_2$
- B.  $T_1 = T_2$
- C.  $T_1 < T_2$
- D. None of these

**Answer: A**



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13. From the p-T graph what conclusion can be drawn?



A.  $V_2 = V_1$

B.  $V_2 < V_1$

C.  $V_2 > V_1$

D. None of these

Answer: C



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14. A cylinder contains 20 kg of  $N_2$  gas ( $M = 28 \text{ kg } K^{-1} \text{ mol}^{-1}$ ) at a pressure of 5 atm. The mass of hydrogen ( $M = 2 \text{ kg } K^{-1} \text{ mol}^{-1}$ ) at a pressure of 3 atm contained in the same cylinder at same temperature is

A. 1.08 kg

B. 0.86 kg

C. 0.68 kg

D. 1.68 kg

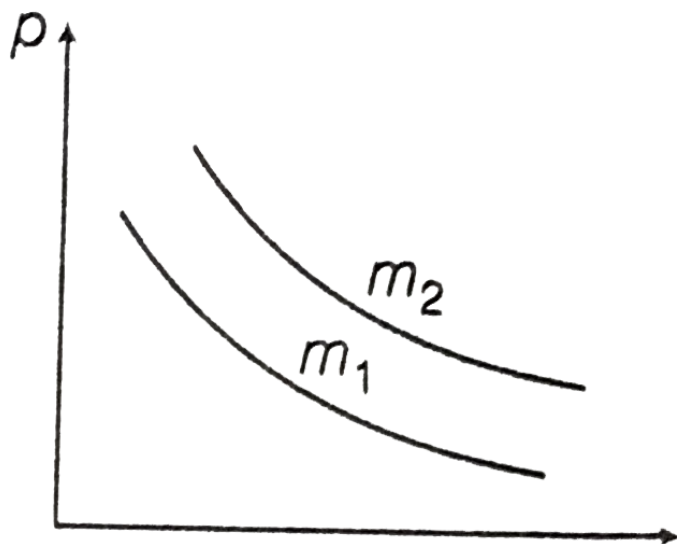
**Answer: B**



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15. Two different isotherms representing the relationship between pressure  $p$  and volume  $V$  at a given temperature of the same ideal gas are

shown for masses  $m_1$  and  $m_2$  then



A.  $m_1 > m_2$

B.  $m_1 = m_2$

C.  $m_1 < m_2$

D. Nothing can be predicted

**Answer: C**



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16. A gas is found to obey the law  $P^2V = \text{constant}$ . The initial temperature and volume are  $T_0$  and  $V_0$ . If the gas expands to a volume  $3V_0$ , its final temperature becomes

A.  $\frac{T_0}{3}$

B.  $\frac{T_0}{\sqrt{3}}$

C.  $3T_0$

D. None of these

**Answer: D**



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17. A gas has volume  $V$  and pressure  $p$ . The total translational kinetic energy of all the molecules of the gas is

A.  $3/2 pV$  only if the gas is monoatomic

B.  $3/2 pV$  only if the gas is diatomic



C.  $3/2$  pV in all cases

D. None of above

**Answer: C**



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18. A vessel contains a mixture of one of oxygen and two moles of nitrogen at  $300K$ . The ratio of the average rotational kinetic energy per  $O_2$  molecule to  $N_2$  molecule is .

A. 1:1

B. 1:2

C. 2:1

D. 8:7

**Answer: A**



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19. Two monoatomic gases are at absolute temperatures 300 K and 350 K respectively. Ratio of average kinetic energy of their molecules is

A. 7:6

B. 6:7

C. 36:49

D. 49:36

**Answer: B**



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20. At  $27^\circ C$  temperature, the kinetic energy of an ideal gas is  $E_1$ . If the temperature is increased to  $327^\circ C$ , then the kinetic energy will be

A.  $\frac{E_1}{\sqrt{2}}$

B.  $\sqrt{2}E$

C.  $2E_1$

D.  $\frac{E_1}{2}$

**Answer: C**



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21. Temperature remaining constant, the pressure of gas is decreased by 20%. The percentage change in volume

A. increases by 20%

B. decreases by 20%

C. increases by 25%

D. decreases by 25%

**Answer: C**



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22. One litre of an ideal gas at  $27^{\circ}C$  is heated at a constant pressure to  $297^{\circ}C$ . Then, the final volume is approximately

A. 1.2 L

B. 1.9 L

C. 19 L

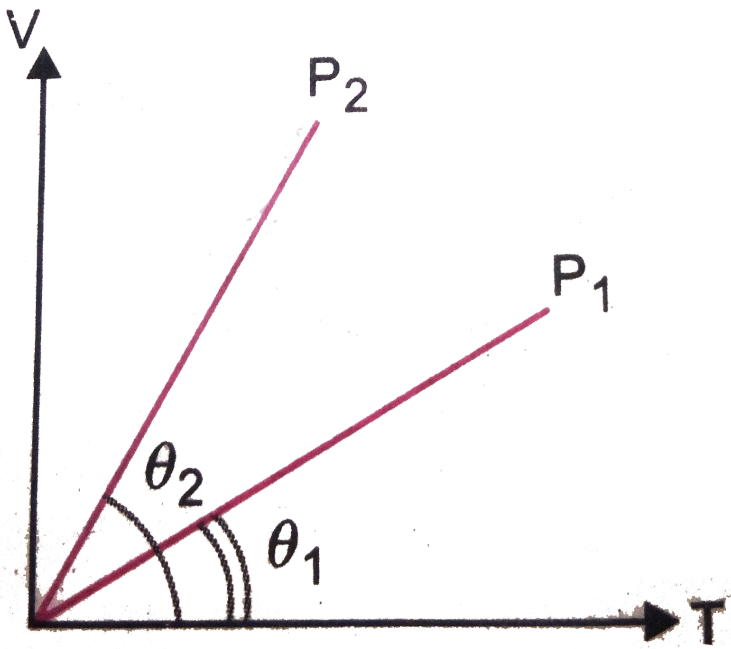
D. 2.4 L

**Answer: B**



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23. In the given (V-T) diagram, what is the relation between pressure  $P_1$  and  $P_2$ ?



A.  $p_2 = p_1$

B.  $p_2 > p_1$

C.  $p_2 < p_1$

D. Cannot be predicted

**Answer: C**



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24. The gas in a vessel is subjected to a pressure of 20 atmosphere at a temperature  $27^{\circ}C$ . The pressure of the gas in the vessel after one half of the gas is released from the vessel and the temperature of the remainder is raised by  $50^{\circ}C$  is

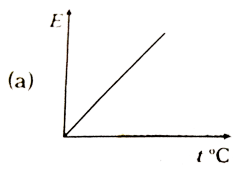
- A. 8.5 atm
- B. 10.8 atm
- C. 11.7 atm
- D. 17 atm

**Answer: C**

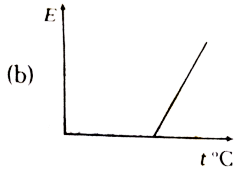


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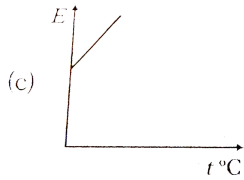
25. The graph which represents the variation of mean kinetic energy of molecules with temperature  $^{\circ}C$  is ?



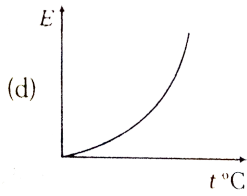
A.



B.



C.



D.

**Answer: C**



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**A Tacking It Together**

1. Heat given to a system can be associated with

- A. kinetic energy of amotion of molecules
- B. kinetic energy of orderly motio of molecules
- C. total kinetic energy of random and orderly motion of molecules
- D. dinetic energy of random motion in some csases and kinetic energy of orderly motion in other

**Answer: A**



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2. Boyles's Law is applicable for an

- A. adiabatic process
- B. isothermal process
- C. isobaric process

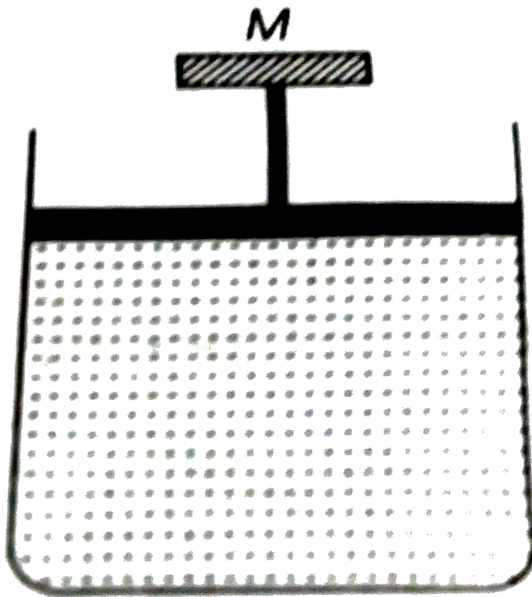


D. isochoric process

Answer: B

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3. A cylinder containing an ideal gas is in vertical position and has a piston of mass  $M$  that is able to move up or down without friction (figure). If the temperature is increased



A. both  $p$  and  $V$  of the gas will change

B. only  $p$  will increase according to Charles' law

C.  $V$  will change but not  $p$

D.  $p$  will change but not  $V$

**Answer: A**



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4. The absolute zero temperature in Fahrenheit scale is

A.  $-273^{\circ} F$

B.  $-32^{\circ} F$

C.  $-460^{\circ} F$

D.  $-132^{\circ} F$

**Answer: C**



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5. On which of the following scales of temperature, the temperature is never negative

- A. Celsius
- B. Fahrenheit
- C. Reaumur
- D. Kelvin

**Answer: D**



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6. In a mercury thermometer the ice point (lower fixed point) is marked as  $10^{\circ}$  and the steam point (upper fixed point) is marked as  $130^{\circ}$ . At  $40^{\circ}C$  temperature, what will this thermometer read?

- A.  $78^{\circ}$
- B.  $66^{\circ}$

C.  $62^\circ$

D.  $58^\circ$

**Answer: D**



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7. On a new scale of temperature (which is linear) and called the  $W$  scale. The freezing and boiling points of water are  $39^\circ W$  and  $239^\circ W$  respectively. What will be the temperature on the new scale, corresponding to a temperature of  $39^\circ C$  on the Celsius scale?

A.  $200^\circ W$

B.  $139^\circ W$

C.  $78^\circ W$

D.  $117^\circ W$

**Answer: D**



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8. A centigrade and a Fahrenheit thermometer are dipped in boiling water. The water temperature is lowered until the Fahrenheit thermometer registers  $140^\circ$ . What is the fall in temperature as registered by the centigrade thermometer?

A.  $30^\circ$

B.  $40^\circ$

C.  $60^\circ$

D.  $80^\circ$

**Answer: B**

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9. A constant volume gas thermometer show pressure reading of 50cm and 99 cm of mercury at  $0^\circ C$  and  $100^\circ C$  respectively. When the pressure

reading is 60 cm of mercury, the temperature is

A.  $25^\circ$

B.  $40^\circ$

C.  $15^\circ$

D.  $12.5^\circ$

**Answer: A**



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**10.** A metal rod of silver at  $0^\circ C$  is heated to  $100^\circ C$ . Its length is increased by  $0.19cm$ . Coefficient of cubical expansion of the silver rod is

A.  $5.7 \times 10^{-5} / C$

B.  $0.63 \times 10^{-5} / C$

C.  $1.9 \times 10^{-5} / C$

D.  $16.1 \times 10^{-5} / C$

**Answer: A**



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11. The volume of a gas at  $20^{\circ}C$  is  $100 \text{ cm}^3$  at normal pressure. If it is heated to  $100^{\circ}C$ , its volume becomes  $125 \text{ cm}^3$  at the same pressure, then volume coefficient of the gas at normal pressure is

A.  $0.0015 / ^{\circ}C$

B.  $0.0045 / ^{\circ}C$

C.  $0.0025 / ^{\circ}C$

D.  $0.0033 / ^{\circ}C$

**Answer: D**



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12. Coefficient of apparent expansions of mercury is  $0.18 \times 10^{-3} / ^\circ C$ . If the density of mercury at  $0^\circ C$  is  $13.6g/cc$  its density at  $473K$  will be

A.  $13.11g/cc$

B.  $26.22g/cc$

C.  $52.11g/cc$

D. None of these

**Answer: A**



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13. A clock with a metal pendulum beating seconds keeps correct time at  $0^\circ C$ . If it loses 12.5 s a day at  $25^\circ C$  the coefficient of linear expansion of metal pendulum is

A.  $\frac{1}{86400} / ^\circ C$

B.  $\frac{1}{43200} / ^\circ C$



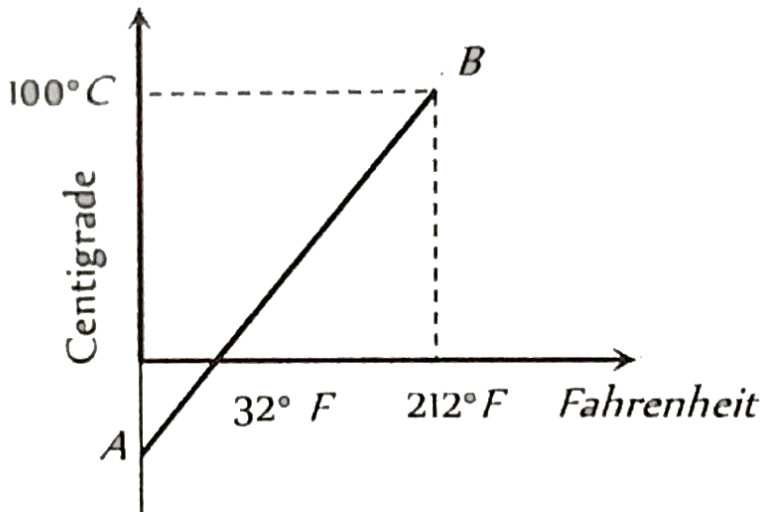
C.  $\frac{1}{14400} / ^\circ C$

D.  $\frac{1}{28800} / ^\circ C$

Answer: A

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14. The graph AB shown in figure is a plot of temperature of a body in degree celsius and degree Fahrenheit. Then



A. Slope of line AB is  $9/5$

B. Slope of line AB is  $5/9$

C. Slope of line AB is  $1/9$

D. Slope of line AB is  $3/9$

**Answer: B**

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15. If at same temperature and pressure, the densities for two diatomic gases are respectively  $d_1$  and  $d_2$ , then the ratio of velocities of sound in these gases will be

A.  $d_1 d_2$

B.  $\sqrt{d_2 / d_1}$

C.  $\sqrt{d_1 / d_2}$

D.  $\sqrt{d_1 d_2}$

**Answer: B**

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16. A gas at the temperature 250 K is contained in a closed vessel. If the gas is heated through 1K, then the percentage increase in its pressure will be

A. 0.4 %

B. 0.2 %

C. 0.1 %

D. 0.8 %

**Answer: A**



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17. An electron tube was sealed off during manufacture at a pressure of  $1.2 \times 10^{-7}$  mm of mercury at  $27^\circ C$ . Its volume is  $100 \text{ cm}^3$ . The number of molecules that remain in the tube is

A.  $2 \times 10^{16}$

B.  $3 \times 10^{15}$

C.  $3.86 \times 10^{11}$

D.  $5 \times 10^{11}$

**Answer: C**

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**18.** At what temperature is the root mean square velocity of gaseous hydrogen molecules is equal to that of oxygen molecules at  $47^\circ C$ ?

A. 20 K

B. 80 K

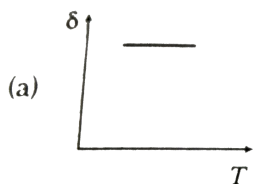
C.  $-73K$

D. 3 K

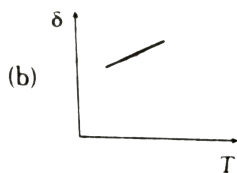
**Answer: A**

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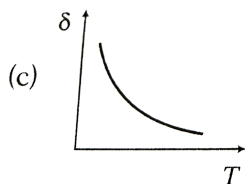
19. An ideal gas is initially at temperature  $T$  and volume  $V$ . Its volume is increased by  $\Delta V$  due to an increase in temperature  $\Delta T$ , pressure remaining constant. The quantity  $\delta = \frac{\Delta V}{V\Delta T}$  varies with temperature as



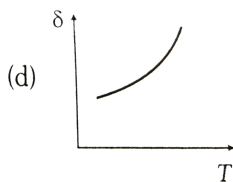
A.



B.



C.



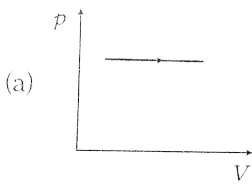
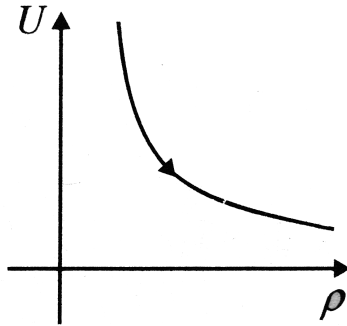
D.

Answer: C

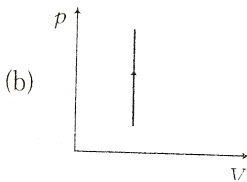


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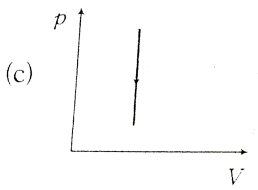
20. Variation of internal energy with density of 1mole of monatomic gas is depicted in Fig. Corresponding variation of pressure with volume can be depicted as (assume the curve is rectangular hyperbola)



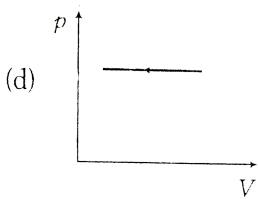
A.



B.



C.



D.

**Answer: D**



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21. A chamber containing a gas was evacuated till the vacuum attained was  $10^{-14}$  m of Hg. If the temperature of the chamber was  $30^\circ C$ , the number of molecules that remains in it per cubic metre is

A.  $3.2 \times 10^{11}$

B.  $3.2 \times 10^{12}$

C.  $2.3 \times 10^{12}$

D.  $2.3 \times 10^{10}$

**Answer: A**



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22. A bimetallic strip is made of aluminium and steel ( $\alpha_{Al} > \alpha_{steel}$ ). On heating, the strip will

- A. remains straight
- B. get twisted
- C. will bend with aluminium on concave side
- D. will bend with steel on concave side

**Answer: D**



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23. A uniform metallic rod rotates about its perpendicular bisector with constant angular speed. If it is heated uniformly to raise its temperature slightly, then

- A. its speed of rotation increases
- B. its speed rotation decreases
- C. its speed of rotation remains same
- D. its speed increase because its moment of inertia increases

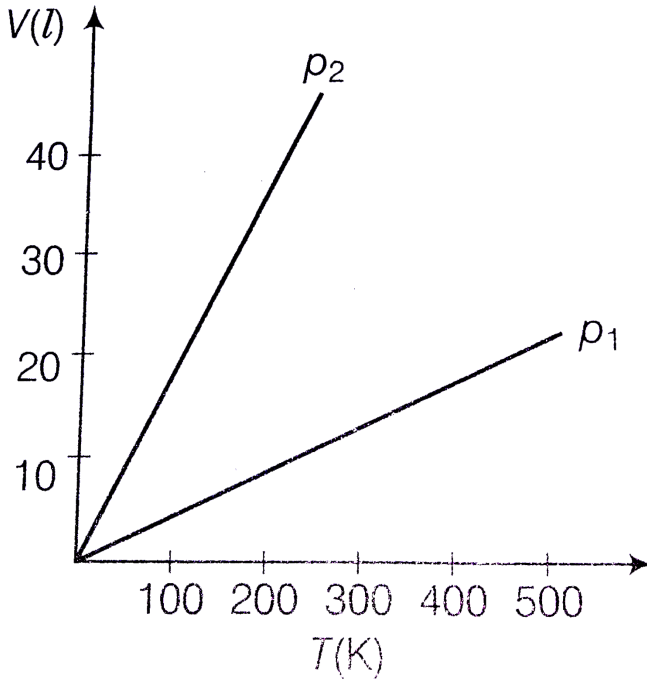
**Answer: B**



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24. Volume versus temperature graphs for a given mass of an ideal gas are shown in figure. At two different values of constant pressure. What

can be inferred about relation between  $P_1$  and  $P_2$  ?



A.  $p_1 > p_2$

B.  $p_1 = p_2$

C.  $p_1 < p_2$

D. Data is insufficient

**Answer: A**



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25. As the temperature is increased, the period of a pendulum

- A. increase as its effective length increases even though its centre of mass still remains at the centre of the bob
- B. decreases as its effective length increases even though its centre of mass still remains at the centre of the bob
- C. increases as its effective length increases due to shifting to centre of mass below the centre of the bob
- D. decrease as its effective length remains same but the centre of mass shifts above the centre of the bob

**Answer: A**



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26. An aluminium sphere is dipped into water. Which of the following is true ?

- A. Buoyancy will be less in water at  $0^\circ C$  than that in water at  $4^\circ C$
- B. Buoyancy will be more in water at  $0^\circ C$  than that in water at  $4^\circ C$
- C. Buoyancy in water at  $0^\circ C$  will be same as that in water at  $4^\circ C$
- D. Buoyancy may be more or less in water at  $4^\circ C$  depending on the radius of the sphere

**Answer: A**



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27. The radius of a metal sphere at room temperature  $T$  is  $R$ , and the coefficient of linear expansion of the metal is  $\alpha$ . The sphere is heated a little by a temperature  $\Delta T$  so that its new temperature is  $T + \Delta T$ . The increase in the volume of the sphere is approximately

A.  $2\pi R\alpha\Delta T$

B.  $\pi R^2\alpha\Delta T$

C.  $4\pi R^3\alpha\Delta T / 3$

$$D. 4\pi R^3 \alpha \Delta T$$

**Answer: D**



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**28.** A cubic vessel (with face horizontal + vertical ) contains an ideal gas at NTP. The vessel is being carried by a rocket which is moving at a speed of  $500\text{ms}^{-1}$  in vertical direction. The pressure of the gas inside the vessel as observed by us on the ground.

A. remains the same because  $500\text{ms}^{-1}$  is very much smaller than  $v_{rms}$  of the gas

B. remains the same because motion of the vessel as a whole does not affect the relative motion of the gas molecules and the walls

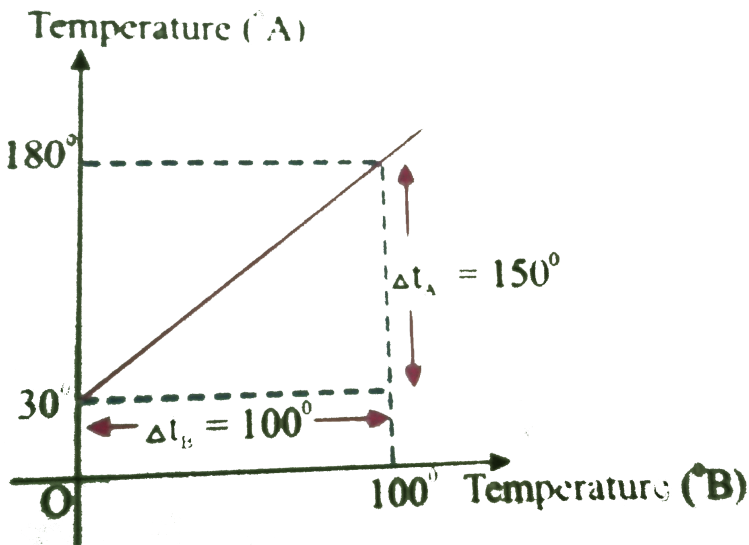
C. will increase by a factor equal to  $(v_{rms}^2 + (500)^2) / v_{rms}^2$  where  $v_{rms}$  was the original mean square velocity of the vessel

D.

Answer: B

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29. The graph between two temperature scales  $A$  and  $B$  is shown in Fig. Between upper fixed point and lower fixed point there are 150 equal divisions on scales  $A$  and 100 on scale  $B$ . The relation between the temperature in two scales is given by\_



A.  $\frac{t_A - 180}{100} = \frac{t_B}{150}$

B.  $\frac{t_A - 30}{150} = \frac{t_B}{100}$

$$C. \frac{t_A - 180}{150} = \frac{t_A}{100}$$

$$D. \frac{t_B - 40}{100} = \frac{t_A}{180}$$

**Answer: C**



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30. 1 mole of  $H_2$  gas is contained in box of volume  $V = 1.00m^3$  at  $T = 300K$ . The gas is heated to a temperature of  $T = 3000$  K and the gas gets converted to a gas of hydrogen atoms. The final pressure would be (considering all gases to be ideal)

- A. same as the pressure initially
- B. 2 time the pressure initially
- C. 10 times the pressure initially
- D. 20 times the pressure initially

**Answer: D**



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31. An inflated rubber balloon contains one mole of an ideal gas has a pressure  $p$ , volume  $V$  and temperature  $T$ . if the temperature rises to  $1.1 T$ , and the volume is increased to  $1.05 V$ , the final pressure will be

A.  $1.1 p$

B.  $p$

C. less than  $p$

D. between  $p$  and  $1.1 p$

**Answer: A**

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32. A glass vessel of volume  $V_o$  is completely filled with volume of the liquid will overflow? Coefficient of linear expansion of glass  $=\alpha$  and coefficient of volume expansion of the liquid  $=\gamma_l$



A.  $2V_o\Delta T(\gamma_l - 3\alpha_g)$

B.  $V_o\Delta T(\gamma_l - 3\alpha_g)$

C.  $V_o\Delta T(\gamma_l - \alpha_g)$

D.  $\frac{V_o\Delta T}{2}(\gamma_l - 3\alpha_g)$

**Answer: B**



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**33.** The steam point and the ice point of a mercury thermometer are marked as  $80^\circ$  and  $10^\circ$ . At what temperature on centigrade scale the reading of this thermometer will be  $59^\circ$  ?

A.  $70^\circ C$

B.  $60^\circ C$

C.  $40^\circ C$

D.  $50^\circ C$

**Answer: A**



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**34.** Two uniform brass rods A and B of length  $l$  and  $2l$  and radii  $2r$  respectively are heated to the same temperature. The ratio of the increase in the volume of A to that of B is

A. 1 : 1

B. 1 : 2

C. 2 : 1

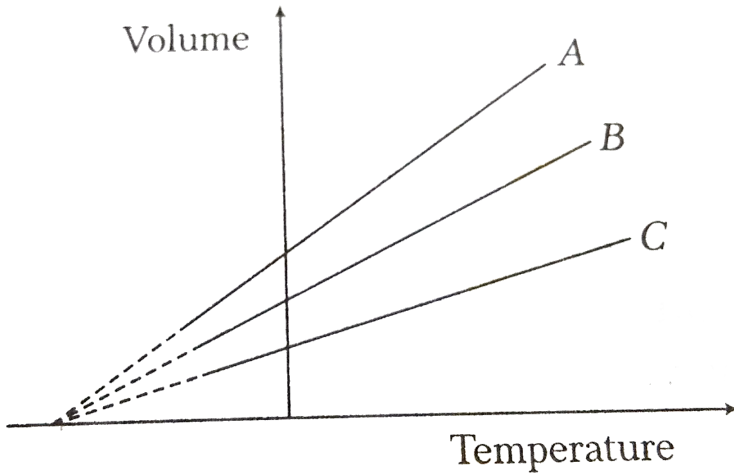
D. 1 : 4

**Answer: C**



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35. The expansion of an ideal gas of mass  $m$  at a constant pressure  $p$  is given by the straight line B. Then, the expansion of the same ideal gas of mass  $2m$  at a pressure  $2p$  is given by the straight line.



A. C

B. A

C. B

D. None of these

**Answer: C**



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36. The root mean square velocity of the molecules in a sample of helium is  $\frac{5}{7}$ th that of the molecules in a sample of hydrogen. If the temperature of hydrogen sample is  $0^\circ C$ , then the temperature of the helium sample is about

- A.  $0^\circ C$
- B. 0 K
- C.  $273^\circ C$
- D.  $100^\circ C$

**Answer: A**

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37. At room temperature, the rms speed of the molecules of a certain diatomic gas is found to be  $1930\text{ m/s}$ . The gas is

- A.  $H_2$

B.  $F_2$

C.  $O_2$

D.  $Cl_2$

**Answer: A**

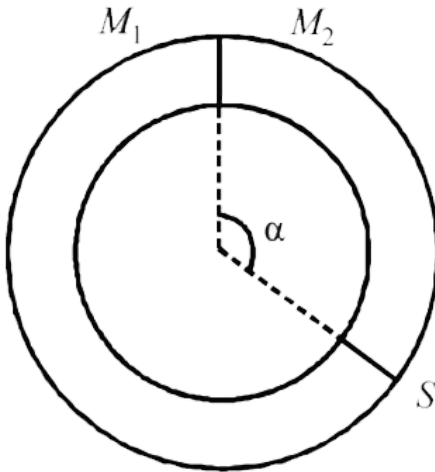


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**38.** A ring shaped tube contain two ideal gases with equal masses and relative molar masses  $M_1 = 32$  and  $M_2 = 28$ .

The gases are separated by one fixed partition and another movable stopper S which can move freely without friction inside the ring. The

angle  $\alpha$  as shown in the figure is ..... degrees.



A. 291

B. 219

C. 129

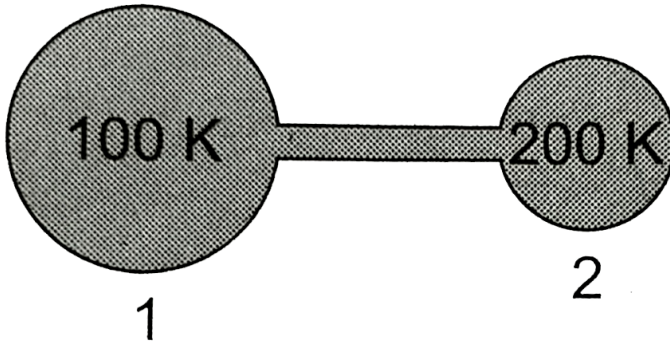
D. 192

**Answer: D**



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39. Figure shows two flasks connected to each other. The volume of the flask 1 is twice that of flask 2. The system is filled with an ideal gas at temperature  $100K$  and  $200K$  respectively. If the mass of the gas in 1 be  $m$  then what is the mass of the gas in flask 2



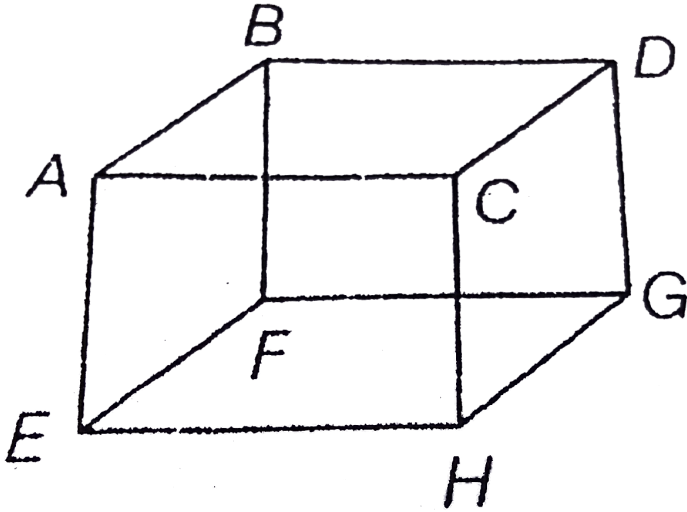
- A.  $m$
- B.  $m/2$
- C.  $m/4$
- D.  $m/8$

**Answer: C**



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40. Mole of an ideal gas is contained in a cubical volume  $V$ , ABCDEFGH at 300 K (figure). One face of the cube (EFGH) is made up of a material which totally absorbs any gas molecule incident on it .At any given time.



- A. the pressure on EFGH would be zero
- B. the pressure on all the faces will be equal
- C. the pressure on EFGH would be double the pressure on ABCD
- D. the pressure on EFGH would be half that on ABCD

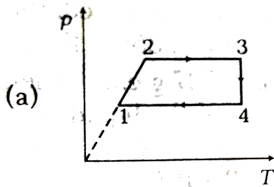
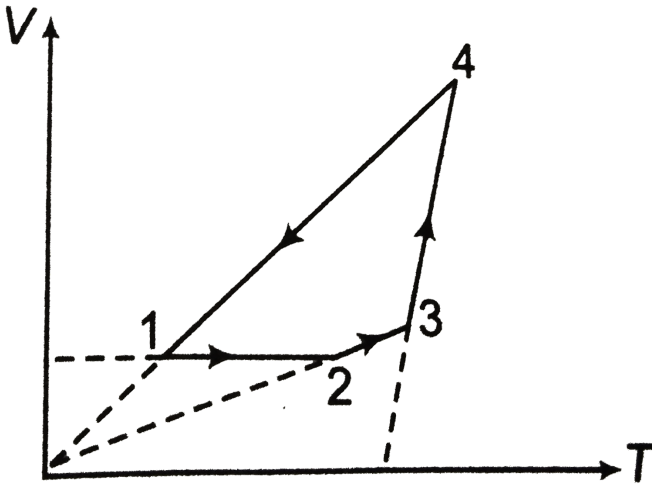
Answer: A



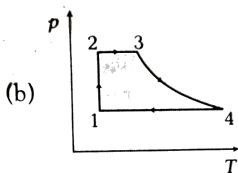
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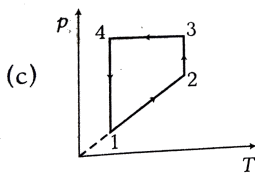
41. A cyclic process 1-2-3-4-1 is depicted on V-T diagram. The p-T and p-V diagrams for this cyclic process are given below. Select the correct choices (more than one options is/are correct)



A.



B.

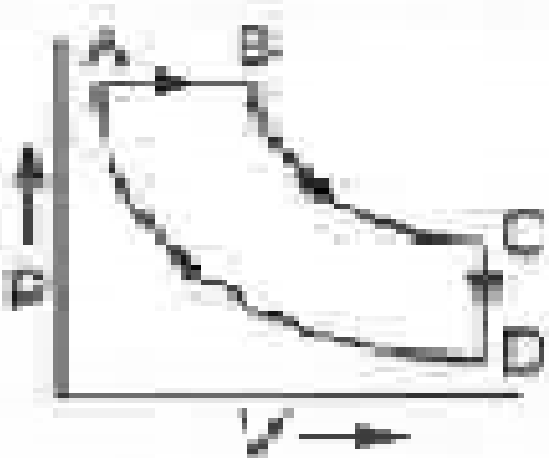


C.

D. None of these

**Answer: C**

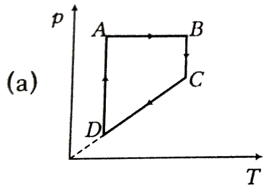
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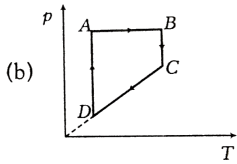
42.

A cyclic process ABCD is shown in the p-V diagram. Which of the following

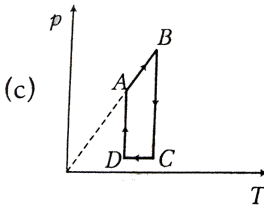
curves represent the same process?



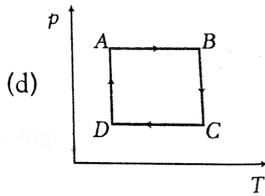
A.



B.



C.



D.

**Answer: A**



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43. Find the average kinetic energy per molecule at temperature  $T$  for an equimolar mixture of two ideal gases A and B, where A is monoatomic and B is diatomic.

A.  $2 kT$

B.  $4 kT$

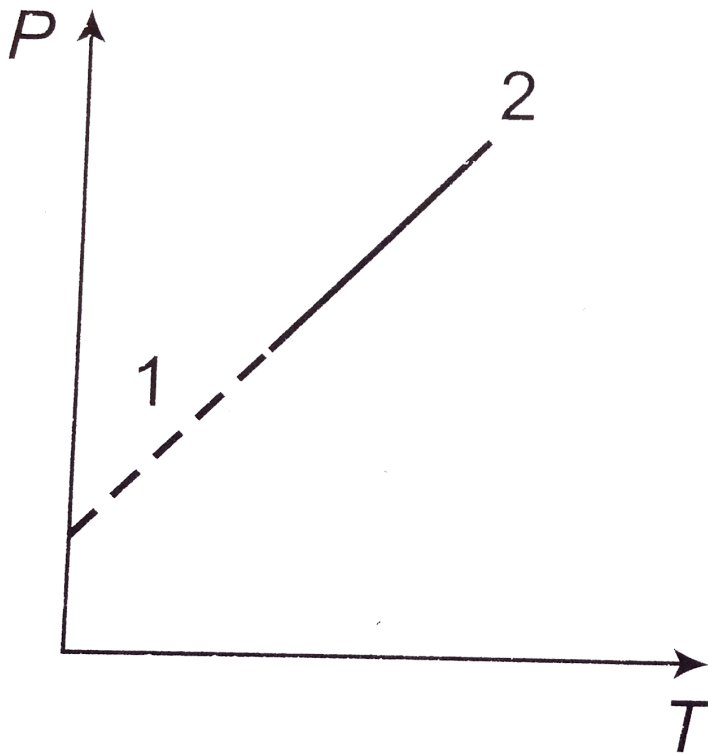
C.  $3 kT$

D.  $8 kT$

**Answer: B**



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44.

A pressure  $P$ , absolute temperature  $T$ , graph was obtained when a given mass of a gas heated. During the heating process from the state 1 to the state 2, the volume

- A. remained constant
- B. decreased
- C. increased
- D. changed erratically

**Answer: C**



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45. A sphere of diameter 7.0 cm and mass 266.5 g float in a bath of liquid. As the temperature is raised, the sphere begins to sink at a temperature of  $35^{\circ}C$ . If the density of liquid is  $1.527gcm^{-3}$  at  $0^{\circ}C$ , find the coefficient of cubical expansion of the liquid. Neglect the expansion of the sphere.

A.  $0.0043/^{\circ}C$

B.  $0.00083/^{\circ}C$

C.  $0.00025/^{\circ}C$

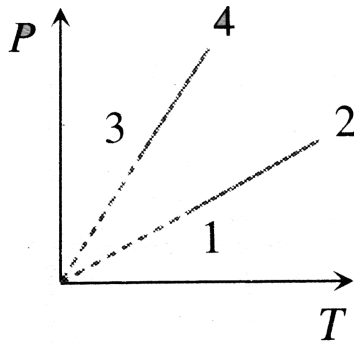
D.  $0.00010/^{\circ}C$

**Answer: B**



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46. Pressure versus temperature graph of an ideal gas of equal number of moles of different volumes is plotted as shown in Fig. Choose the correct alternative.



- A.  $V_1 = V_2, V_3 = V_4$  and  $V_2 > V_3$
- B.  $V_1 = V_2, V_3 = V_4$  and  $V_2 < V_3$
- C.  $V_1 = V_2 = V_3 = V_4$
- D.  $V_4 = V_3 = V_2 = V_1$

**Answer: A**



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47. A cylindrical steel plug is inserted into a circular hole of diameter 2.60 cm in a brass plate. When the plug and the plates are at a temperature of  $20^{\circ}C$ , the diameter of the plug is 0.010 cm smaller than that of the hole.

The temperature at which the plug will just fit in it is

$$\left( \text{Given, } \alpha_{steel} = \frac{11 \times 10^{-6}}{^{\circ}C} \text{ and } \alpha_{brass} = \frac{19 \times 10^{-6}}{C} \right)$$

- A.  $-48^{\circ}C$
- B.  $-20^{\circ}C$
- C.  $-10^{\circ}C$
- D.  $-485^{\circ}C$

**Answer: D**

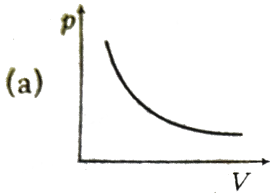
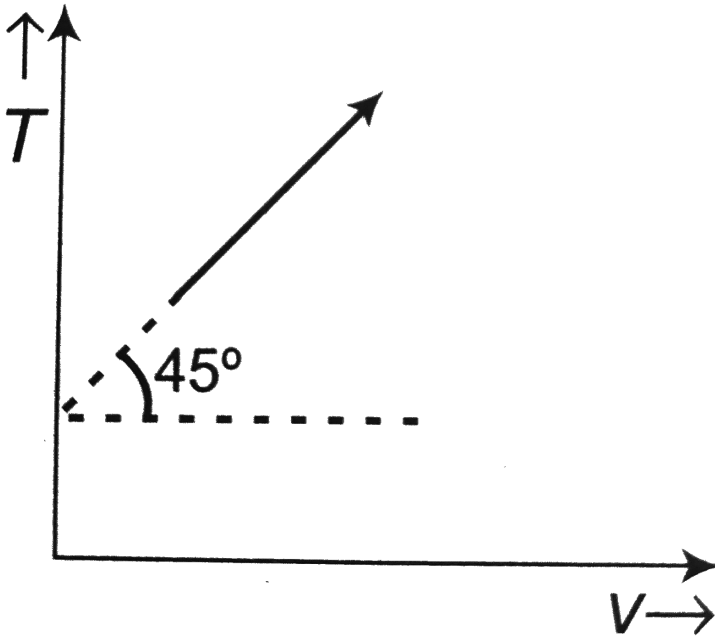


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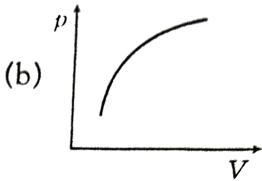
48. The given curve represents the variation of temperature as a function of volume for one mole of an ideal gas. Which of the following curves



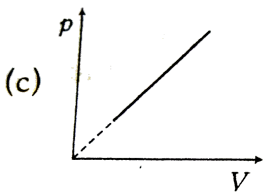
best represents the variation of pressure as a function of volume?



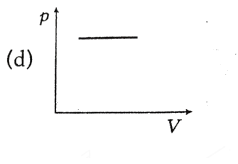
A.



B.



C.



D.

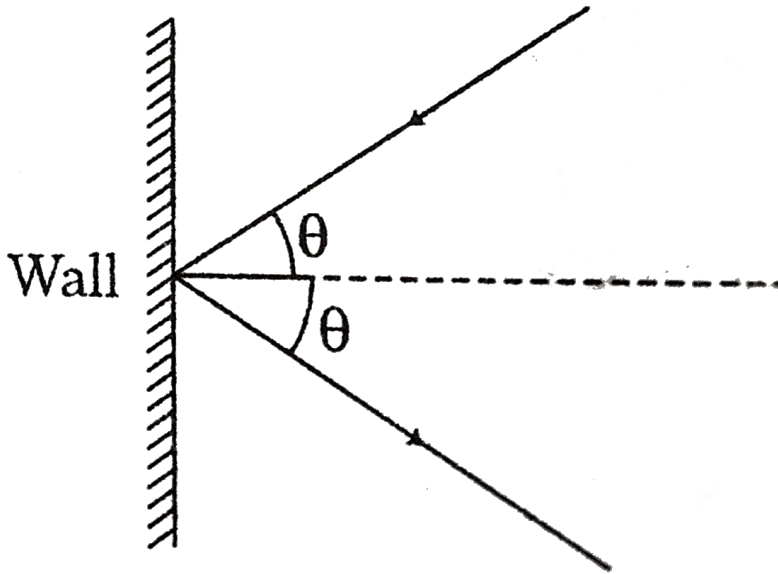
**Answer: A**



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**49.** The mass of hydrogen molecule is  $3.32 \times 10^{-27}$  kg. If  $10^{23}$  hydrogen molecules strike per second at  $2 \text{ cm}^2$  area of a rigid wall at an angle of  $45^\circ$  from the normal and rebound back with a speed of  $1000 \text{ m.s}^{-1}$ , then

the pressure exerted on the wall is



A.  $2.34 \times 10^3 \text{ Pa}$

B.  $0.23 \times 10^6 \text{ Pa}$

C.  $0.23 \times 10^3 \text{ Pa}$

D.  $23.4 \times 10^3 \text{ Pa}$

**Answer: A**



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50. The apparent coefficient of expansion of liquid, when heated in a copper vessel is  $C$  and when heated in a silver vessel is  $S$ . If  $A$  is the linear coefficient of expansion of Copper, linear expansion coefficient of silver is

A.  $\frac{C + S - 3A}{3}$

B.  $\frac{C - S - 3A}{3}$

C.  $\frac{S + 3A - C}{3}$

D.  $\frac{C + S + 3A}{3}$

**Answer: B**



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51. Two identical containers joined by a small pipe initially contain the same gas at pressure  $p_0$  and absolute temperature  $T_0$ . One container is now maintained at the same temperature while the other is heated to  $2T_0$ . The common pressure of the gases will be

A.  $\frac{3}{2}p_o$

B.  $\frac{4}{3}p_o$

C.  $\frac{3}{5}p_o$

D.  $2p_o$

**Answer: B**



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52. A piece of metal weighs 46 g in air. When it is immersed in a liquid of specific gravity 1.24 at  $27^\circ C$ , it weighs 30 g. When the temperature is raised to  $42^\circ C$ , the metal piece weighs 30.5 g. If the specific gravity of the liquid at  $42^\circ C$  is 1.20, the coefficient of linear expansion of the metal is

A.  $(1.4 \times 10^{-5}) / ^\circ C$

B.  $(2.3 \times 10^{-5}) / ^\circ C$

C.  $(4.3 \times 10^{-5}) / ^\circ C$

D.  $(3.4 \times 10^{-5}) / ^\circ C$

**Answer: B**



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53. A vertical cylinder closed at both ends is fitted with a smooth piston dividing the volume into two parts each containing one mole of air. At the equilibrium temperature of 320 K, the upper and lower parts are in the ratio 4:1. The ratio will become 3:1 at a temperature of

A. 450 K

B. 228 K

C. 420 K

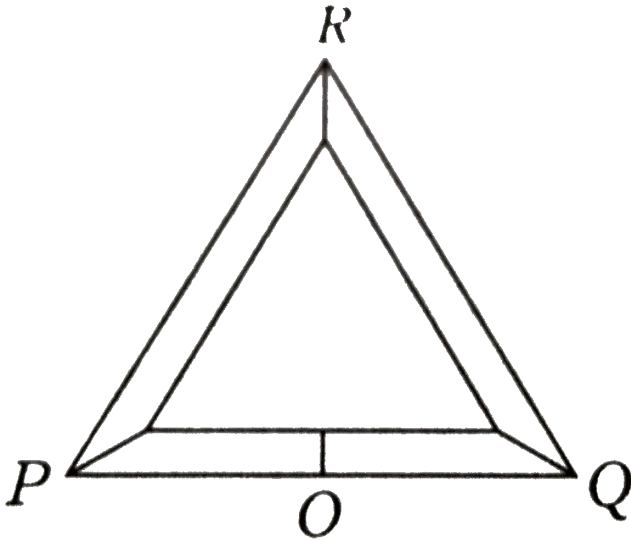
D. 570 K

**Answer: A**



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54. Three rods of equal  $l$  are joined to form an equilateral triangle  $PQR$ .  $O$  is the mid-point of  $PQ$ . Distance  $OR$  remains same for small change in temperature. Coefficient of linear expansion for  $PR$  and  $RQ$  is same i.e.,  $\alpha_2$  but for  $PQ$  is  $\alpha_1$ . Then

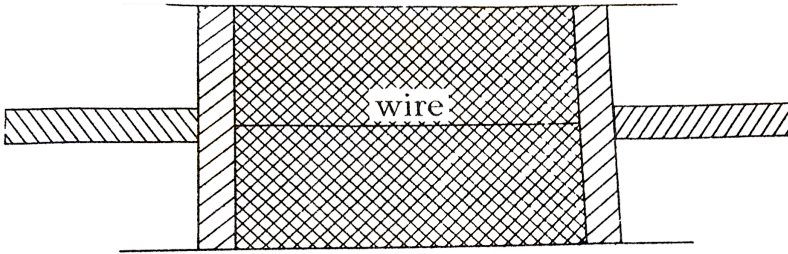


- A.  $\alpha_2 = 3\alpha_1$
- B.  $\alpha_2 = 4\alpha_1$
- C.  $\alpha_1 = 3\alpha_2$
- D.  $\alpha_1 = 4\alpha_2$

**Answer: D**



55. A cylindrical tube of uniform cross-sectional area  $A$  is fitted with two air tight frictionless pistons.



The pistons are connected to each other by a metallic wire. Initially the pressure of the gas is  $p_o$  and temperature is  $T_o$ , atmospheric pressure is also  $p_o$ . Now the temperature of the gas is increased to  $2T_o$ , the tension in the wire will be

A.  $2p_oA$

B.  $p_oA$

C.  $\frac{p_oA}{2}$

D.  $p_oA$



**Answer: B**



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## B Medical Entrance Special Format Questions

1. Assertion At the same temperature and pressure, equal volumes of all gases contain equal number of molecules.

Reason In 1 L at NTP total number of molecules are  $6.02 \times 10^{23}$ .

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: C**



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2. Assertion In isochoric process  $p$ - $V$  graph is straight line parallel to  $p$ -axis.

Reason In isochoric process density  $p$  remains constant.

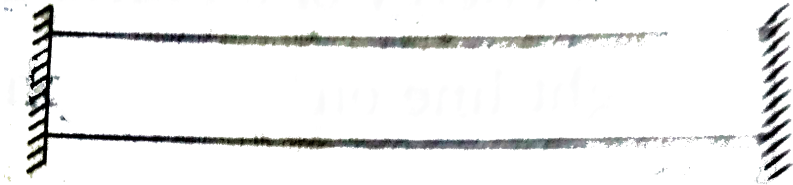
- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: B**



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3. Assertion A metallic rod is fixed from two ends as shown in figure. When the temperature is increased compressive stresses are developed in the rod.



Reason At higher temperature, natural length of the rod will be more.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: A**



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4. Assertion Pressure of a gas is given as  $p = \frac{2}{3}E$ .

Reason In the above expression, E represents kinetic energy of the gas per unit volume.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: C**



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5. Assertion An actual gas behaves as an ideal gas most closely at low pressure and high temperature.

Reason At low pressure and high temperature, real gases obey the gas laws.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: A**



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**6. Assertion** In summers, a metallic scale will read more than the actual.

**Reason** In summers, length of metallic scale will increase.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: D**



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7. Assertion Total kinetic energy of any gas at temperature T would be

$$\frac{1}{2}mv_{rms}^2$$

Reason Translational kinetic energy of any type of gas temperature T

would be  $\frac{3}{2}RT$  of one mole.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

**Answer: B**

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8. Assertion If a gas chamber containing a gas is moved translationally, then temperature of gas will increase.

Reason Total kinetic energy of the gas molecules will increase by the translational motion of gas chamber.

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.

**Answer: D**



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9. Assertion Degree of freedom of a monoatomic gas is always three, whether we consider vibrational effects or not.

Reason At all temperatures (low or high), vibrational kinetic energy of an ideal gas is zero

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false.

D. If Assertion is false but Reason is true.



**Answer: C**



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**10.** Assertion Pressure of a gas is  $\frac{2}{3}$  times translational kinetic energy of gas molecules.

Reason Translational degree of freedom of any type of gas is three, whether the gas is monoatomic, diatomic or polyatomic.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: C**



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11. Assertion Total internal energy of oxygen gas at a given temperature is  $E$  of this energy  $\frac{3}{5} E$  is rotational kinetic energy.

Reason Potential energy of an ideal gas is zero.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: B**



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12. Assertion Straight line on V-T graph represents isobaric process.

Reason If  $V \propto T$ , then  $p = \text{constant}$  i.e., process is isobaric.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: D**



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13. Assertion Any straight line on V-T diagram represents isobaric process.

Reason In isobaric process, if  $V$  is doubled, then  $T$  will also become two times.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: D**



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**14.** Assertion At triple point, three states (solid, liquid and gas) may co-exist simultaneously.

Reason For water, the values of pressure and temperature corresponding to triple point are 10 mm of Hg and 273.16 K.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If Assertion is false but Reason is true.

**Answer: C**

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## Match The Columns

1. For a monatomic gas at temperature  $T$ , match the following columns.

Column I

- (A) Speed of sound  
(B) RMS speed of gas molecules  
(C) Average speed of gas molecules  
(D) Most probable speed of gas molecules

Column II

- (p)  $\sqrt{2RT/M}$   
(q)  $\sqrt{8RT/\pi M}$   
(r)  $\sqrt{3RT/M}$   
(s)  $\sqrt{5RT/3M}$



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2. Match the following columns.

Column I

Column II

(A)  $Inp = \frac{2}{3}E, E$  is

(p) isochoric

(B)  $InU = 3RT$  for and monatomic gas  $U$  is

(q) Translational kinetic energy

(C)  $\frac{V}{T} = \text{constant}$  is valid for

(r) Internal energy of one mole

(D)  $\frac{p}{T} = \text{constant}$  is associated with

(s) isobaric process



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3. In the process  $T \propto W$ , pressure of the gas increase from  $p_o$  to  $t_o$

Match the columns.

Column I

Column II

(A) Temperature of the gas

(p) Positive

(B) Volume of the gas

(q) Negative

(C) work done by the gas

(r) Two times

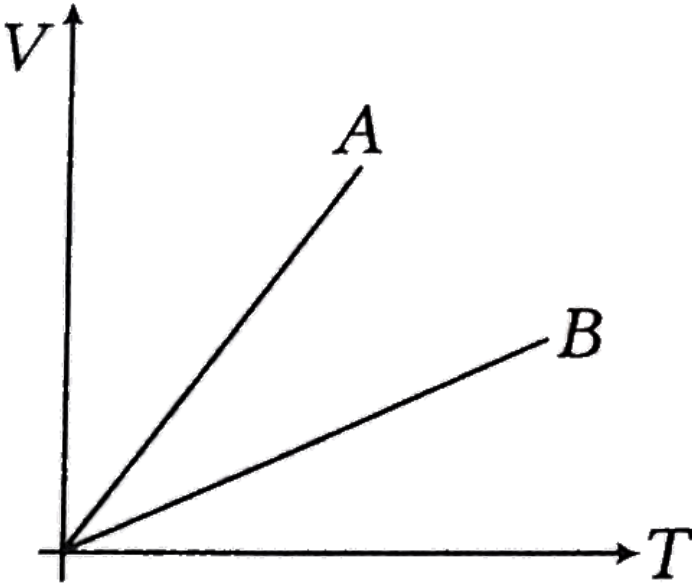
(D) Heat supplies to the gas

(s) Cannot say anything



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4. In the V-T graph shown in the figure match the following columns.



Column I	Column II
(A) Gas A is ... and gas B is ...	(p) Monoatomic, diatomic
(B) $p_A/p_B$ is	(q) Diatomic, monoatomic
(C) $n_A/n_B$ is	(r) $>1$
	(s) $<1$
	(t) Cannot say anything



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Column I

Column II

5. (A) Gas A is ... and gas B is ... (p) Monoatomic, diatomic  
(B)  $p_A/p_B$  is (q) Diatomic, monoatomic  
(C)  $n_A/n_B$  is (r)  $> 1$   
(s)  $< 1$   
(t) cannot say anything

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## Medical Entrance Gallery

1. A given sample of an ideal gas occupies a volume  $V$  at a pressure  $p$  and absolute temperature  $T$ . The mass of each molecule of the gas is  $m$ . Which of the following gives the density of the gas ?

- A.  $p/(kT)$   
B.  $pm/(kT)$   
C.  $p/(kTV)$   
D.  $mkT$



**Answer: B**



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2. Coefficient of linear expansion of brass and steel rods are  $\alpha_1$  and  $\alpha_2$ . Length of brass and steel rods are  $l_1$  and  $l_2$  respectively. If  $(l_2 - l_1)$  is maintained same at all temperatures, which one of the following relations hold good ?

A.  $\alpha_1 l_2^2 = \alpha_2 l_1^2$

B.  $\alpha_1^2 l_2 = \alpha_2^2 l_1$

C.  $\alpha_1 l_1 = \alpha_2 l_2$

D.  $\alpha_1 l_2 = \alpha_2 l_1$

**Answer: C**



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3. The molecules of a given mass of a gas have rms velocity of  $200 \text{ m/s}$  at  $27^\circ \text{C}$  and  $1.0 \times 10^5 \text{ N/m}^2$  pressure. When the temperature and pressure of the gas are respectively  $127^\circ \text{C}$  and  $0.05 \times 10^5 \text{ N/m}^2$ , the rms velocity of its molecules in  $\text{m/s}$  is

- A.  $\frac{400}{\sqrt{3}}$
- B.  $\frac{100\sqrt{2}}{3}$
- C.  $\frac{100}{3}$
- D.  $100\sqrt{2}$

**Answer: A**

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4. The rms speed of oxygen molecule in a gas at  $27^\circ \text{C}$  would be given by

- A.  $483 \text{ m/s}$
- B.  $966 \text{ m/s}$

C.  $4.83 \text{ ms}^{-1}$

D.  $9.66 \text{ ms}^{-1}$

**Answer: A**



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5. The pressure of an ideal gas is directly proportional to

A. total kinetic energy

B. translational kinetic energy

C. rotational kinetic energy

D. vibrational kinetic energy

**Answer: A**



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6. Two metal rods of lengths  $L_1$  and  $L_2$  and coefficients of linear expansion  $\alpha_1$  and  $\alpha_2$  respectively are welded together to make a composite rod of length  $(L_1 + L_2)$  at  $0^\circ C$ . Find the effective coefficient of linear expansion of the composite rod.

A.  $\frac{L_1\alpha_1^2 - L_2\alpha_2^2}{L_1^2 + L_2^2}$

B.  $\frac{L_1^2\alpha_1 - L_2^2\alpha_2}{L_1^2 + L_2^2}$

C.  $\frac{L_1\alpha_1 + L_2\alpha_2}{L_1 - L_2}$

D.  $\frac{L_1\alpha_1 + L_2\alpha_2}{L_1 + L_2}$

**Answer: D**



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7. The ratio of rms speed of an ideal gas molecules at pressure  $p$  to that at pressure  $2p$  is

A. 1 : 2

B.  $2:1$

C.  $1:\sqrt{2}$

D.  $\sqrt{2}:1$

**Answer: C**

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8. The rms speed of oxygen molecules in a gas is  $v$ . If the temperature is doubled and the oxygen molecules dissociate into oxygen atoms, the rms speed will become

A.  $v$

B.  $\sqrt{2}v$

C.  $2v$

D.  $4v$

**Answer: C**



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9. The deviation of a real gas from the ideal one is minimum at

- A. low pressure and high temperature
- B. low temperature and low pressure
- C. high pressure and low temperature
- D. high pressure and high temperature

**Answer: A**



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10. The density of hydrogen gas at STP is  $0.9 \text{ kg m}^{-3}$ . The mean kinetic energy of one gram molecule of hydrogen gas is approx

- A. 3403 T
- B. 3500 J

C. 3704 J

D. 3207 J

**Answer: A**



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11. A substance having coefficient of critical expansion  $4.9 \times 10^{-4} \text{ } ^\circ\text{C}^{-1}$ .

The fractional change in the density for rise in temperature 30 K is

A. 0.0012

B. 0.1280

C. 0.0235

D. 0.0145

**Answer: D**



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12. At constant pressure, the ratio of increases in volume of an ideal gas per degree rise in kelbin temperature to its volume is

A.  $1/T$

B.  $1/T^2$

C.  $T$

D.  $T^2$

**Answer: A**



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13. When water is heated from  $0^{\circ}C$  to  $10^{\circ}C$ , its volume

A. does not change

B. decreases

C. first decreases and then increases

D. increases



**Answer: C**



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14. The length of a steel rod exceeds that of a brass rod by 5 cm. If the difference in their lengths remains same at all temperature, then the length of brass rod will be: ( $\alpha$  for iron and brass are  $12 \times 10^{-6} / ^\circ C$  and  $18 \times 10^{-6} / ^\circ C$ , respectively)

A. 20 cm

B. 15 cm

C. 5 cm

D. 10 cm

**Answer: D**



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15. The density of water is maximum at:

A.  $4^{\circ}C$

B.  $> 4^{\circ}C$

C.  $< 4^{\circ}C$

D.  $10^{\circ}C$

**Answer: A**



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16. A metal rod is fixed rigidly at two ends so as to prevent its thermal expansion. If  $L, \alpha, Y$  respectively denote the length of the rod, coefficient of linear thermal expansion and Young's modulus of its material, then for an increase in temperature of the rod by  $\Delta T$ , the longitudinal stress developed in the rod is

A. inversely proportional to  $\alpha$

- B. inversely proportional to  $Y$
- C. directly proportional to  $\Delta T/Y$
- D. independent of  $L$

**Answer: C**

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17. Which one of the following is a wrong statement in kinetic theory of gases?

- A. The gas molecules are in random motion.
- B. The gas molecules are perfect elastic spheres.
- C. The volum occupied by the molecules of a gas is negligible.
- D. The collision between molecules is inelastic.

**Answer:**

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18. The mean free path of molecules of a gas (radius  $r$ ) is inversely proportional to

A.  $r^3$

B.  $r^2$

C.  $r$

D.  $\sqrt{r}$

**Answer: B**



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19. The average pressure of an ideal gas is

A.  $p = (1/3)mnV_{av}^2$

B.  $p = (1/2)mnV_{av}$

C.  $p = (1/4)mnV_{av}^2$

$$D. p = (1/3)mnV_{av}$$

**Answer: A**



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**20.** According to equipartition law of energy each particle in a system of particles have thermal energy  $E$  equal to

A.  $E = k_B T$

B.  $E = (1/2)k_B T$

C.  $E = 3k_B T$

D.  $E = (3/2)k_B T$

**Answer: B**



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21. When a liquid is heated in a glass vessel, its coefficient of apparent expansion is  $1.03 \times 10^{-3} / ^\circ C$ . When the same liquid is heated in a copper vessel, its coefficient of apparent expansion is  $1.006 \times 10^{-3} / ^\circ C$ . If the coefficient of linear expansion of copper is  $17 \times 10^{-6} / ^\circ C$ , then the coefficient of linear expansion of glass

A.  $8.5 \times 10^{-4} / ^\circ C$

B.  $9 \times 10^{-6} / ^\circ C$

C.  $27 \times 10^{-6} / ^\circ C$

D.  $10 \times 10^{-4} / ^\circ C$

**Answer: B**



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22. A horizontal tube, open at both ends, contains a column of liquid. The length of this liquid column does not change with temperature. Let  $\gamma$  :

coefficient of volume expansion of the liquid and  $\alpha$  : coefficient of linear expansion of the material of the tube

A.  $\gamma = 2\alpha$

B.  $\gamma = 3\alpha$

C.  $\gamma = 4\alpha$

D.  $\gamma = \alpha$

**Answer: A**



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**23.** The average kinetic energy of a molecule of a gas at absolute temperature  $T$  is proportional to

A. directly temperature  $T$  is

B. inversely proportional to  $T^2$

C. directly proportional to  $T^2$

D. inversely proportional to T

**Answer: C**

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24. At what temperature. The rms velocity of gas molecules would be double of its value at NTP,if pressure is remaining constant?

A.  $819^{\circ}C$

B. 819 K

C. 546 K

D.  $546^{\circ}C$

**Answer: A**

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25. The average kinetic energy per mole of hydrogen at given temperature is

- A. equal of that of oxygen
- B. 16 times that of oxygen
- C.  $1/16$  times that of oxygen
- D.  $1/8$  times that of oxygen

**Answer: A**



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26. In kinetic theory of gases, it is assumed that molecular collisions are

- A. for negligible duration
- B. inelastic
- C. one-dimensional (head on)
- D. unable to exert mutual force

**Answer: A**



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**27.** The number of molecules in a litre of a gas at temperature of  $27^{\circ}C$  and a pressure of  $10^6$  dyne  $cm^{-2}$

A.  $2.4 \times 10^{20}$

B.  $2.4 \times 10^{21}$

C.  $2.4 \times 10^{22}$

D.  $2.4 \times 10^{23}$

**Answer: C**



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**28.** How many degrees of freedom have the gas molecules, if under standard conditions the gas density is  $1.3kgm^{-3}$  and the velocity of

sound propagation in it is  $C = 330ms^{-1}$ .

A. 5

B. 6

C. 7

D. 8

**Answer: A**



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**29.** A non-conducting body floats in a liquid at  $20^{\circ}C$ . with  $2/3$  of its volume immersed in the liquid When liquid temperature is increased to  $100^{\circ}C$ ,  $3/4$  of body volume is immersed in the liquid. Then the coefficient of real expansion of the liquid is... (neglecting the expansion of container of the liquid)

A.  $15.6 \times 10^{-4} / ^{\circ}C$

B.  $156 \times 10^{-4} / ^{\circ}C$

C.  $1.56 \times 10^{-4} / ^\circ C$

D.  $0.156 \times 10^{-4} / ^\circ C$

**Answer: A**



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**30.** During an experiment, an ideal gas is found to obey an additional law

$VP^2 = \text{constant}$ , The gas is initially at a temperature  $T$ , and volume  $V$ .

When it expands to a volume  $2V$ , the temperature becomes.....

A.  $\frac{T}{2}$

B.  $2T$

C.  $\sqrt{T}2$

D.  $\frac{T}{\sqrt{2}}$

**Answer: C**



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