# DPP
DAILY PRACTICE PROBLEMS

**CLASS : XIth**
**Date :**

**Solutions**

**SUBJECT : PHYSICS**
**DPP No. :9**

# Topic :- KINETIC THEORY

1 **(c)**

Kinetic energy $\propto$ Temperature

2 **(d)**

$PV = nRT$

$\Rightarrow PV = \frac{\omega}{M} RT$

$\frac{PM}{RT} = \frac{\omega}{V} = e$

$\Rightarrow e = \frac{PM}{RT} = \frac{P \times m \times N_A}{RT} = \frac{Pm}{\left(\frac{R}{N_A}\right)T} = \frac{Pm}{kT}$

3 **(b)**

Thermal energy corresponds to internal energy

Mass=1 kg

Density = 4 kg m$^{-3}$

Volume = $\frac{\text{Mass}}{\text{Density}} = \frac{1}{4}$ m$^3$

Pressure = $8 \times 10^4$ Nm$^{-2}$

$\therefore$ Internal energy $= \frac{5}{2} p \times V = 5 \times 10^4$ J

4 **(b)**

$V_t = V_0(1 + \alpha t) = 0.5\left(1 + \frac{1}{273} \times 819\right) = 2\ litre = 2 \times 10^{-3} m^3$

5 **(c)**

Here, $m = 10$ g $=10^{-2}$ kg

$v = 300$ ms$^{-1}$,$\theta = ?C, = 150$ J-kg$^{-1}$K$^{-1}$

$Q = \frac{50}{100}\left(\frac{1}{2} mv^2\right) = \frac{1}{4} \times 10^{-2}(300)^2 = 225$ J

From $Q = cm\,\theta$

$\theta = \frac{Q}{cm} = \frac{225}{150 \times 10^{-2}} = 150°\text{C}$

6 **(a)**

At constant temperature

$PV =$ constant

$\Rightarrow \frac{P_1}{P_2} = \frac{V_2}{V_1} \Rightarrow \frac{70}{120} = \frac{V_2}{1200} \Rightarrow V_2 = 700\ ml$

7 **(d)**

$P \propto \frac{1}{V} \Rightarrow \frac{V_2}{V_1} = \frac{P_1}{P_2} = \frac{100}{105} \Rightarrow V_2 = \frac{100}{105} V_1 = 0.953\ V_1$

% change in volume $= \frac{V_1 - V_2}{V_1} \times 100$

$= \frac{V_1 - 0.953 V_1}{V_1} \times 100 = 4.76\%$

8 **(a)**

Average kinetic energy $E = \frac{f}{2} kT = \frac{3}{2} kT$

$\Rightarrow E = \frac{3}{2} \times (1.38 \times 10^{-23})(273 + 30) = 6.27 \times 10^{-21} J$

$= 0.039 eV < 1\ eV$

9 **(c)**

$\because C_P - C_v = R$

Fractional part of heat energy $= \frac{C_P - R}{C_P}$

$= \frac{\frac{7}{2}R - R}{\frac{7}{2}R} = \frac{5}{7}$

10 **(c)**

RMS velocity doesn't depend upon pressure, it depends upon temperature only,

*ie.*, $v_{\text{rms}} \propto \sqrt{T}$.

$\Rightarrow \quad \frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}} \Rightarrow \frac{200}{v_2} = \sqrt{\frac{(273 + 27)}{(273 + 127)}} = \sqrt{\frac{300}{400}}$

$\Rightarrow \quad v_2 = \frac{400}{\sqrt{3}}$ m/s

11 **(a)**

$\frac{F}{2} n_1 k T_1 + \frac{F}{2} n_2 k T_2 + \frac{F}{2} n_3 k T_3$

$= \frac{F}{2}(n_1 + n_2 + n_3) kT$

$T = \frac{n_1 T_1 + n_2 T_2 + n_3 T_3}{n_1 + n_2 + n_3}$

12 **(a)**

As $\rho - \rho_0(1 - \gamma \Delta T)$

$\therefore\ 9.7 = 10(1-\gamma\times 100)$

$\frac{9.7}{10} = 1-\gamma\times 100$

$\gamma\times 100 = 1-\frac{9.7}{10} = \frac{0.3}{10} = 3\times 10^{-2}$

$\gamma = 3\times 10^{-4}\ \therefore\ \alpha = \frac{1}{3}\gamma = 10^{-4}{}^{\circ}C^{-1}$.

14 **(b)**

Let the temperature of junction be$Q$. In equilibrium, rate of flow of heat through rod 1= sum of rate of flow of heat through rods 2 and 3.

$\left(\frac{dQ}{dt}\right)_1 = \left(\frac{dQ}{dt}\right)_2 + \left(\frac{dQ}{dt}\right)_3$

$KA\frac{(\theta-0)}{l} = \frac{KA(90^\circ-\theta)}{l} + \frac{KA(90^\circ-\theta)}{l}$

$\theta = 2(90^\circ-\theta)$

$3\theta = 180^\circ, \theta = \frac{180^\circ}{3} = 60^\circ$

15 **(a)**

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{(P+h\rho g)1.0}{273+12} = \frac{P.V_2}{273+35}$

$V_2 = 5.4cm^3$

16 **(d)**

Average kinetic energy $\propto$ Temperature

$\Rightarrow\frac{E_1}{E_2} = \frac{T_1}{T_2}\Rightarrow\frac{100}{E_2} = \frac{300}{450}\Rightarrow E_2 = 150J$

17 **(a)**

Let $p_1$ and $p_2$ are the initial and final pressures of the gas filled in $A$. Then

$p_1 = \frac{n_ART}{V}$ and $p_2 = \frac{n_ART}{2V}$

$\Delta p = p_2 - p_1 = -\frac{n_ART}{2V}$

$= -\left(\frac{m_A}{M}\right)\frac{RT}{2V}$ ...(i)

where $M$ is the atomic weight of the gas.

Similarly, $1.5\Delta p = -\left(\frac{m_B}{M}\right)\frac{RT}{2V}$ ...(ii)

Dividing Eq.(ii) by Eq. (i), we get

$1.5 = \frac{m_B}{m_A}$ or $\frac{3}{2} = \frac{m_B}{m_A}$

or $3m_A = 2m_B$

18 **(c)**

From $\frac{\Delta Q}{\Delta t} = KA\left(\frac{\Delta T}{\Delta x}\right)$

$$\Delta t = \frac{\Delta Q \Delta x}{KA(\Delta T)}$$

In arrangement (b), $A$ is doubled and $\Delta x$ is halved.

$\therefore\ \Delta t \rightarrow \frac{1/2}{2} \rightarrow \frac{1}{4}$ time

$ie, \frac{1}{4} \times 4$ min= 1 min

19 **(b)**

Here , $m = 0.1$ kg, $h_1 = 10$m, $h_2 = 5.4$ m

$c = 460$ J-kg$^{-1}$°C$^{-1}$, g = 10ms$^{-2}$, θ = ?

Energy dissipated, $Q = mg(h_1 - h_2)$

$= 0.1 \times 10(10 - 5.4) = 4.6j$ J

From $Q = c\,m\,\theta$

$$\theta = \frac{Q}{cm} = \frac{4.6}{460 \times 0.1} = 0.1℃$$

20 **(b)**

Root mean square speed

$$v_{\text{rms}} \propto \frac{1}{\sqrt{\rho}}$$

$$\therefore \qquad \frac{v_{\text{rms}1}}{v_{\text{rms}2}} = \sqrt{\frac{\rho_2}{\rho_1}}$$

Given, $\frac{\rho_1}{\rho_2} = \frac{9}{8}$

$$\Rightarrow \qquad \frac{v_{\text{rms}1}}{v_{\text{rms}2}} = \sqrt{\frac{8}{9}} = \frac{2\sqrt{2}}{3}$$

| Q. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **A.** | C | D | B | B | C | A | D | A | C | C |
| | | | | | | | | | | |
| Q. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| **A.** | A | A | A | B | A | D | A | C | B | B |
| | | | | | | | | | | |