UNIT TEST-04

Subject : Physics
Class : XI

Q.1 (4)	**Q.2** (4)	**Q.3** (2)	**Q.4** (4)	**Q.5** (3)	**Q.6** (1)	**Q.7** (2)	**Q.8** (2)	**Q.9** (3)	**Q.10** (1)
Q.11 (2)	**Q.12** (*)	**Q.13** (1)	**Q.14** (2)	**Q.15** (3)	**Q.16** (1)	**Q.17** (4)	**Q.18** (4)	**Q.19** (3)	**Q.20** (2)
Q.21 (3)	**Q.22** (4)	**Q.23** (4)	**Q.24** (2)	**Q.25** (1)	**Q.26** (2)	**Q.27** (2)	**Q.28** (1)	**Q.29** (4)	**Q.30** (4)
Q.31 (2)	**Q.32** (4)	**Q.33** (4)	**Q.34** (3)	**Q.35** (3)	**Q.36** (2)	**Q.37** (3)	**Q.38** (2)	**Q.39** (1)	**Q.40** (3)
Q.41 (4)	**Q.42** (4)	**Q.43** (3)	**Q.44** (1)	**Q.45** (2)	**Q.46** (1)	**Q.47** (2)	**Q.48** (1)	**Q.49** (3)	**Q.50** (1)

Q.1 (4)

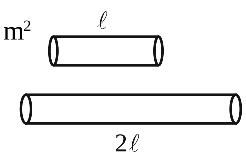
Due to tension, intermolecular distance between atoms is increased and therefore potential energy of the wire is increased and with the removal of force interatomic distance is reduced and so is the potential energy. This change in potential energy appears as heat in the wire and thereby increases the temperature.

Q.2 (4)

$A = 0.1\ cm^2 = 0.1 \times 10^{-4}\ m^2$

$Y = 2 \times 10^{11}$

$\Delta\ell = \ell$



$$Y = \frac{F\ell}{AD\ell} = \frac{F}{A}\cdot\frac{t}{t} = \frac{F}{A}$$

$F = 2 \times 10^{11} \times 0.1 \times 10^{-4}$

$F = 2 \times 10^6$

Q.3 (2)

Q.4 (4)

$$U = \frac{1}{2}\left(\frac{YA}{L}\right)l^2\, l. \qquad \therefore\ U \propto l^2$$

$$\frac{U_2}{U_1} = \left(\frac{l_2}{l_1}\right)^2 = \left(\frac{10}{2}\right)^2 = 25 \Rightarrow U_2 = 25U_1$$

i.e. potential energy of the spring will be 25 *V*

Q.5 (3)

$P_0 + \rho g d_1 = P_1$

$P_0 + \rho g d_2 = P_2$

$\rho g(d_2 - d_1) = P_2 - P_1$

$10^3 \times 10\,(d_2 - d_1) = 3.03 \times 10^6$

$d_2 - d_1 = 303\ m$

$\simeq 300\ m$

Q.6 (1)

$P_A = P_B$

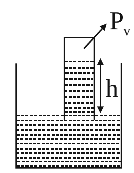
$P_0 + h_w\rho_w g = P_0 + h_0\rho_0 g$

$h_1 \times 10^3 g = 20 \times 0.9 \times 10^3 g$

$h_1 = 18\ cm$

Q.7 (2)

$P_{atm} = h\rho g + P_v$



As P_v decreases due to increase in volume

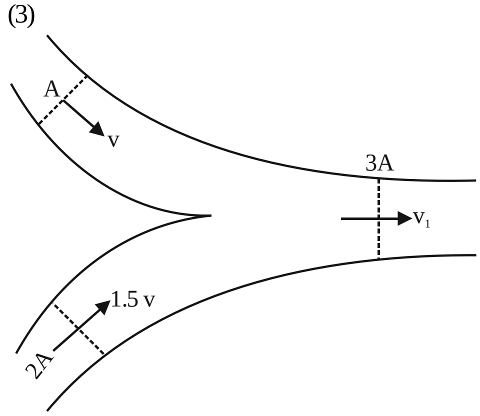
$\therefore$ h increases

Q.8 (2)

Bernoulli's theorem is based on law of conservation of energy.

For liquids, surface tension decreases with increase in temperature

Q.9 (3)



$AV + 2A\,(1.5\ v) = 3Av_1 \Rightarrow v_1 = 4v/3$

$$\text{Now}\ \frac{v_1}{1.5v} = \frac{4v \times 2}{3v \times 3} = \frac{8}{9}$$

Q.10 (1)

$W = T\Delta A = 4\pi R^2 T(n^{1/3} - 1)$

$= 4 \times 3.14 \times (10^{-2})^2 \times 460 \times 10^{-3}[(10)^{6/3} - 1]$

$= 4 \times 3.14 \times (10^{-4}) \times 460 \times 10^{-3}\,[(10^2)^{-1}]$

$= 0.057$

Q.11 (2)

$$M = (\pi r^2)h\rho = \pi r^2\left(\frac{2T\cos\theta}{\rho r g}\right)$$

$M \propto r$

$\therefore$ Doubling radius $\Rightarrow$ mass will also get doubled

$M' = 2M$

Q.12 (*)

$$h = \frac{2T\cos\theta}{r\rho g} \Rightarrow h \propto \frac{1}{r}$$

Q.13 (1)

Excess pressure at common surface is given by

$$P_{ex} = 4T\left(\frac{1}{a}-\frac{1}{b}\right) = \frac{4T}{r}$$

$$\therefore \frac{1}{r} = \frac{1}{a}-\frac{1}{b}$$

$$r = \frac{ab}{b-a}$$

Q.14 (2)

Q.15 (3)

Q.16 (1)

$\Delta\ell = 0.19$ cm

$\Delta T = 100°C$

$\ell = 1m$

$0.19 \times 10^{-2} = 1 \times \alpha \times 100$

$\alpha = 19 \times 10^{-6}$ /°C

$\therefore \gamma = 3\alpha$

$\gamma = 5.7 \times 10^{-5}$/ °C

Q.17 (4)

$Q_1 = Q_2$

$\therefore ms_1(32-20) = ms_2(40-32)$

$$\therefore \frac{s_1}{s_2} = \frac{8}{12} = \frac{2}{3}$$

Q.18 (4)

$$\frac{\Delta Q}{\Delta t} = \frac{kA\Delta T}{L}$$

$$\left(\frac{\Delta Q}{\Delta t}\right)_{C\to A} = \left(\frac{\Delta Q}{\Delta t}\right)_{B\to C}$$

$$\Rightarrow \frac{kA(T_C-20)}{3L} = \frac{kA(100-T_C)}{L}$$

$$\Rightarrow T_C = 80°C$$

Q.19 (3)

Here, $K_1 = K_2$, $l_1 = l_2 = 1m$,

$A_1 = 2A$, $A_2 = A$

$T_1 = 100^oC$, $T_2 = 70^oC$

$\therefore$ Temperature at C be T, then

$$\frac{\Delta Q}{\Delta t} = \frac{K2A(100-T)}{1} = \frac{KA(T-70)}{1}$$

or $T = 90^oC$

Q.20 (2)

By Newton's law of cooling

$$\frac{\theta_1-\theta_2}{t} = -k\left[\frac{\theta_1+\theta_2}{2}-\theta_2\right] \ldots(1)$$

A sphere cools from 62°C to 50°C in 10 min,

$$\frac{62-50}{10} = -k\left[\frac{62+50}{2}-\theta_0\right] \ldots(2)$$

Now, sphere cools from 50°C to 42°C in next 10min.

$$\frac{50-42}{10} = -k\left[\frac{50+42}{2}-\theta_0\right] \ldots(3)$$

Dividing eq^n, (2) by (3) we get,

$$\frac{56-\theta_0}{46-\theta_0} = 0.4\theta_0 = 10.4$$

Hence $\theta_0 = 26°C$

Q.21 (3)

$P = \sigma AT^4$

Intensity $\frac{P}{A} = \sigma T^4$

$\Rightarrow 5.67 \times 10^4 = 5.67 \times 10^{-8} \times T^4$

$\Rightarrow T^4 = 10^{12}$

$\Rightarrow T = 1000$ K

$T = 727^oC$

Q.22 (4)

work done = Area under the P-V curve

$W = \frac{1}{2}(80 \times 10^3)(250 \times 10^{-6}) = 10$ J

Since the arrow is anticlockwise,

$\therefore$ work done = – 10 J

Q.23 (4)

Key idea Heat given to a system (ΔQ) is equal to the sum of increase in the internal energy (Δu) and the work done (ΔW) by the system against the surrounding and 1 cal = 4.2 J.

According to first law of thermodynamics

$\Delta U = Q - W$
$= 2 \times 4.2 \times 1000 - 500$
$= 8400 - 500$
$= 7900\ J$

Q.24 (2)
In process AB
T = constant

P = increases $P \ \alpha \ \frac{1}{V}$

or V = decreases $\Delta Q = \Delta W$.
$\Delta W = -$ ve. or $\Delta Q = -$ ve
$\therefore$ heat is rejected out of the system

Q.25 (1)
$P_1^{1-\gamma} T_1^{\gamma} = P_2^{1-\gamma} T_2^{\gamma}$

$$\left(\frac{T_2}{T_1}\right)^{\gamma} = \left(\frac{P_1}{P_2}\right)^{1-\gamma} \Rightarrow \frac{T_2}{T_1} = \left(\frac{8}{1}\right)^{\frac{1-1.5}{1.5}}$$

$$T_2 = 300 \times (8)^{\frac{-0.5}{1.5}} = \frac{300}{(8)^{1/3}} = \frac{300}{2} = 150K$$

Q.26 (2)
$T_1 V^{\gamma-1} = T_2 (32V)^{\gamma-1}$

$\gamma - 1 = \frac{2}{5}$

$T_1 V^{2/5} = T_2 (32V)^{2/5}$

$\frac{T_1}{T_2} = 4$

$$\eta = 1 - \frac{T_2}{T_1} = \frac{3}{4} \times 100 = 75\%$$

Q.27 (2)

For a diatomic gas, $C_V = \frac{5}{2}R, C_P = \frac{7}{2}R$

At constant pressure, $\Delta Q = nC_P\Delta T = n\left(\frac{7}{2}R\right)\Delta T$ and

$\Delta U = nC_V\Delta T = n\left(\frac{5}{2}R\right)\Delta T$

Form first law of thermodynamics,

$$\Delta W = \Delta Q - \Delta U = n\left(\frac{7}{2}R\right)\Delta T - n\left(\frac{5}{2}R\right)\Delta T = nR\Delta T$$

$$\therefore \Delta Q : \Delta U : \Delta W = \frac{7}{2} : \frac{5}{2} : 1 = 7 : 5 : 2$$

Q.28 (1)

$PV = \mu RT$ Þ $P = \mu RT \times \frac{1}{V}$

$\Rightarrow y = mx$
$\Rightarrow$ slope $\propto$ T

Q.29 (4)

Kinetic energy per gm mole $E = \frac{f}{2}RT$
If nothing is said about gas then we should calculate the translational kinetic energy.

i.e. $E_{trans} = \frac{3}{2}RT = \frac{3}{2} \times 8.31 \times (273 + 0) = 3.4 \times 10^3\ J$

Q.30 (4)
as question
$T_2 = 4T_1$
$T_2 = 4 \times 273 = 1092$
$T_2 = 1092\ K$
$T_2 = 1092 - 273 = 819°C$

Q.31 (2)
RMS speed is given by

$$v_{rms} = \sqrt{\frac{3RT}{M}}$$

At constant temperature

$$v_{rms} \propto \frac{1}{\sqrt{M}}$$

Ratio of v_{rms} of oxygen and hydrogen.

$$\frac{(v_{rms})_O}{(v_{rms})_H} = \sqrt{\frac{M_H}{M_O}}$$

$$\frac{500}{(v_{rms})_H} = \sqrt{\frac{2}{32}} = \frac{1}{4}$$

$(v_{rms})_H = 2000\ m/s$

Q.32 (4)

Q.33 (4)
P = constant
$PV = nRT$
$V \propto T$

$\frac{V}{T}$ = constant

Q.34 (3)

$$\gamma = \frac{f+2}{2} = 1 + \frac{2}{f}$$

$\frac{2}{f} = \gamma - 1$ or $f = \frac{2}{\gamma - 1}$

Q.35 (3)

$$E \propto T \Rightarrow \frac{E_1}{E_2} = \frac{T_1}{T_2} = \frac{300}{350} = \frac{6}{7}$$

Q.36 (2)
Q.37 (3)

Q.38 (2)

$$\text{Volume} = \frac{0.5}{500} = 10^{-3}\,m^3$$

Buoyancy = $\rho Vg = 1000 \times 10^{-3} \times 10$
$= 10\,N$
$m = 1$ kg
If float = 2.5 kg, Reading = 1 + 1.5 = 2.5 kg

Q.39 (1)

Q.40 (3)
Work done = Change in surface energy

$$w = 2T \times 4\pi \left(R_2^2 - R_1^2\right)$$

$= 2 \times 0.03 \times 4\pi\,[(5)^2 - (3)^2] \times 10^{-4}$
$= 0.4\pi$ mJ

Q.41 (4)
Velocity is less at points in contact with the surface of tube and maximum at the middle .

Q.42 (4)
$\theta = ms\,(T_2 - T_1)$

$$-80 = 4 \times \frac{1}{2}\,(T_2 - (-10))$$

$-80 = 2\,(T_2 + 10)$
$-40 - 10 = T_2$
$T_2 = -50°C$

Q.43 (3)

Q.44 (1)
We know that

$$\lambda_{max} \propto \frac{1}{T}$$

$$\frac{\lambda_{1max}}{\lambda_{2\,max}} = \frac{T_2}{T_1} \Rightarrow \frac{T_2}{T_1} = \frac{3}{4} \Rightarrow \frac{T_1}{T_2} = \frac{4}{3}$$

Q.45 (2)
$Q_P = nC_P\,(T_2 - T_1)$

$$140 = n\frac{7}{2}R(T_2 - T_1)$$

$w = nR\,(T_2 - T_1) = 40$ J

Q.46 (1)

Q.47 (2)
From area under P-V curve, we can conclude that $W_3 > W_2 > W_1$

Q.48 (1)

$$V \propto T \Rightarrow \frac{V_1}{V_2} = \frac{T_1}{T_2} \Rightarrow \frac{200}{V_2} = \frac{(273+20)}{(273-20)} = \frac{293}{253}$$

$$V_2 = \frac{200 \times 253}{293} = 172.6\,ml$$

Q.49 (3)
The internal energy of 2 moles of O_2 atom is

$$U_{O_2} = \frac{n_1 f_1}{2}RT = 2 \times \frac{5}{2} \times RT$$

$$U_{O_2} = 5RT$$

The inernal energy of 4 moles of Ar atom is

$$U_{Ar} = \frac{n_2 f_2 RT}{2} = 4 \times \frac{3}{2} \times RT = 6RT$$

$\therefore$ The total internal energy of the system is

$$U = U_{O_2} + U_{Ar} = 5RT + 6RT = 11RT$$

Q.50 (1)

Here $C_p - C_v = R$ and $\dfrac{C_p}{C_v} = \dfrac{5}{3}$

$$\therefore\ C_p = \frac{5}{3}C_v$$

or $$C_v = \frac{R}{\frac{5}{3} - 1} = \frac{8.31}{2/3}$$

or $C_v = 12.5$ J/mol K.