10/09/2025

Phase-2_Code-B

Aakash
Medical | IIT-JEE | Foundations

***Corporate Office :*** AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

**MM : 720**

Fortnightly Test for NEET-2026_RM(P2)_FT-04B

**Time : 180 Min.**

## PHYSICS

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## CHEMISTRY

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## ZOOLOGY

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**158.** (2)

**180.** (2)

## Hints and Solutions

### PHYSICS

**(1)** **Answer :** (1)
**Hint:**
$T^2 \propto r^3$
**Solution:**
$\frac{T_1^2}{T_2^2} = \frac{r_1^3}{r_2^3}$
$T_1$ = 8 hr
$T_2$ = 24 hr
$\left(\frac{8}{24}\right)^2 = \left(\frac{r_1}{r_2}\right)^3$
$\left(\frac{r_1}{r_2}\right) = \left(\frac{1}{3}\right)^{\frac{2}{3}}$

**(2)** **Answer :** (2)
**Solution:**
$T.E = -K.E$

**(3)** **Answer :** (3)
**Solution:**
$g' = g\frac{R^2}{(R+h)^2} = g\left(1\text{-}\frac{d}{R}\right)$
$d = \frac{R}{2} \Rightarrow h = \left(\sqrt{2}-1\right)R$

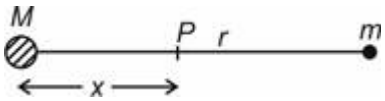
**(4)** **Answer :** (1)
**Solution:**
$\sqrt{\frac{2GM}{R}} = c$
$R = \frac{2GM}{c^2}$

**(5)** **Answer :** (4)
**Solution:**
$F = \frac{K}{r} = \frac{mv^2}{r}$
$v = \sqrt{\frac{K}{m}}$
i.e. independent of "$r$"

**(6)** **Answer :** (4)
**Solution:**
$E = \frac{Gm}{1^2} + \frac{G(2m)}{2^2} - \frac{G(4m)}{4^2} + \ldots$
$E = Gm\left(1 + \frac{1}{2} + \frac{1}{4} + \ldots\right)$
$E = 2Gm$

**(7)** **Answer :** (4)
**Solution:**
$U_i = -\frac{Gm^2}{l}\left(2+3+6\right)$
$U_f = -\frac{Gm^2}{2l}\left(2+3+6\right)$
$W = U_f - U_i$
$W = \frac{11}{2}\frac{Gm^2}{l}$

**(8)** **Answer :** (2)
**Solution:**




$\frac{GM}{x^2} = \frac{Gm}{(r-x)^2}$

$\sqrt{\frac{M}{m}} = \frac{x}{(r-x)}$

$r\sqrt{M} - x\sqrt{M} = x\sqrt{m}$

$x = \frac{r\sqrt{M}}{\sqrt{M}+\sqrt{m}}, \left(r-x\right) = \frac{r\sqrt{m}}{\sqrt{M}+\sqrt{m}}$

$V = V_1 + V_2 = -\frac{GM}{r\sqrt{M}}\left(\sqrt{M}+\sqrt{m}\right) - \frac{Gm}{r\sqrt{m}}\left(\sqrt{M}+\sqrt{m}\right)$

**(9)** **Answer :** (2)
**Solution:**
Applying conservation of energy $U_i + K_i = U_f + K_g$

$\Rightarrow \quad \frac{-Gm^2}{d} + 0 = \frac{-Gm^2}{d/2} + 2\left[\frac{1}{2}mv^2\right]$

$\Rightarrow \quad mv^2 = \frac{2Gm^2}{d} - \frac{Gm^2}{d}$

$\Rightarrow \quad mv^2 = \frac{Gm^2}{d}$

$v = \sqrt{\frac{Gm}{d}}$

**(10)** **Answer :** (1)
**Solution:**
$T_{ext} = \frac{\Delta L}{\Delta t}$
Since, torque on the planet about sun is zero, hence angular momentum of the planet around sun remains constant.

**(11)** **Answer :** (4)
**Solution:**
Gravitational force is always attractive, and it is conservative in nature.

**(12)** **Answer :** (2)
**Solution:**
$l = \frac{-dV}{dr}$
$I \rightarrow$ Gravitational field
$V \rightarrow$ Gravitational Potential
If $I = 0$
$dV = 0$
$V =$ Constant.

**(13)** **Answer :** (3)
**Solution:**
Inside earth, variation of acceleration due to gravity is given by
$g = \frac{GMr}{R^3}$
At center of earth $r = 0$, hence gravity will become zero.

**(14)** **Answer :** (4)
**Solution:**
$F = \frac{Gm(M-m)}{R^2} \quad \Rightarrow \quad a_1 = \frac{Gm(M-m)}{mR^2}$ and $a_2 = \frac{Gm(M-m)}{R^2(M-m)}$

$a_1 = \frac{G(M-m)}{R^2} \mid a_2 = \frac{Gm}{R^2}$

$\vec{a}_{rel} = \vec{a}_1 - \vec{a}_2$

$= \frac{G(M-m)}{R^2} - \left(\frac{-Gm}{R^2}\right) = \frac{GM}{R^2}$

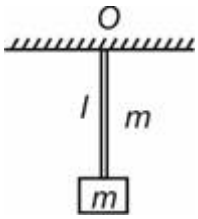
**(15)** **Answer :** (2)
**Solution:**
In 1st case – $T = Mg$
$l = \frac{MgL}{\pi r^2 Y}$

In 2nd case $T = \frac{3}{2}Mg$

$l' = \frac{\frac{3}{2}MgL}{\pi r^2 Y} = \frac{3}{2}l$

**(16)** **Answer :** (1)
**Solution:**
Let the length of the wire be $l_0$.
Elongation $x_1 = (l_1 - l_0)$
$x_2 = (l_2 - l_0)$
$y = \frac{Fl}{A\Delta L} = \frac{Fl_0}{Ax}$
For different tensions of same wire.
$\frac{F_1}{x_1} = \frac{F_2}{x_2} \Rightarrow \frac{T_1}{l_1 - l_0} = \frac{T_2}{l_2 - l_0}$
$\Rightarrow T_1 l_2 - T_1 l_0 = T_2 l_1 - T_2 l_0$
$\Rightarrow (T_2 - T_1) l_0 = T_2 l_1 - T_1 l_2$
$\Rightarrow l_0 = \frac{T_2 l_1 - T_1 l_2}{T_2 - T_1}$

**(17)** **Answer :** (3)
**Solution:**
Tension at the point '$O$' is
$T = 2$ mg




Therefore, corresponding stress $= \frac{2mg}{A}$
At different points on the wire tension is different hence tensile stress is also different.

**(18)** **Answer :** (3)
**Solution:**
Bulk modulus, $\beta = -\frac{\Delta P}{\Delta V / V}$
For a rigid body, $\Delta V = 0 \Rightarrow \beta \to \infty$

**(19)** **Answer :** (1)
**Solution:**
$\eta = \frac{F \times 5 \times 10^{-2}}{(5 \times 10^{-2})^2 \times 0.2 \times 10^{-3}} = 2 \times 10^{11}$
$\Rightarrow F = 2 \times 10^6$ N

**(20)** **Answer :** (1)
**Solution:**
$u = \frac{(F/A)^2}{2 \times Y} = \frac{1}{2}\left[\frac{314 \times 10^3}{\pi \times (20 \times 10^{-3})^2}\right]^2 \times \frac{1}{2 \times 10^{11}}$
$u = \frac{1}{2}(25 \times 10^7)^2 \times \frac{1}{2 \times 10^{11}}$
$u = 1.56 \times 10^5$ J/m$^3$

**(21)** **Answer :** (2)
**Solution:**
Gases do not posses shear modulus of elasticity.

**(22)** **Answer :** (1)
**Solution:**
$k = \frac{YA}{L}$
$\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} \Rightarrow \frac{2L}{YA} = \frac{L}{Y_1 A} + \frac{L}{Y_2 A}$

$\frac{2}{Y} = \frac{1}{Y_1} + \frac{1}{Y_2} \Rightarrow Y = \frac{2Y_1Y_2}{Y_1+Y_2}$

**(23) Answer :** (4)
**Solution:**

$B = \left| \frac{(\Delta P)V}{\Delta V} \right|$

$\frac{\Delta V}{V} = 3\frac{\Delta r}{r} = 3 \times \frac{0.03}{100} = 9 \times 10^{-4}$ ...(i)

$\frac{1}{C} = \frac{(h\rho g)}{\left(\frac{\Delta V}{V}\right)}$

$h = \frac{\Delta V}{V} \times \frac{1}{C \times \rho \times g}$

$h = 9 \times 10^{-4} \times \frac{1}{10^{-10} \times 10^3 \times 10}$

$h = 9 \times 10^2$
$h = 900$ m $= 0.9$ km

**(24) Answer :** (4)
**Solution:**
All the given processes change the elasticity of substance

**(25) Answer :** (1)
**Solution:**
**Sol.:** $E = \frac{1}{2} \times \text{stress} \times \text{strain}$

$E = \frac{1}{2} Y (\text{strain})^2$

$\text{Strain} = \sqrt{\frac{2E}{Y}}$

**(26) Answer :** (4)
**Solution:**

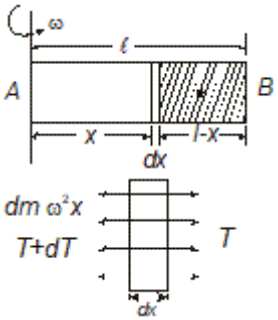
$\frac{Y_A}{Y_B} = \frac{\tan 60^\circ}{\tan 45^\circ} = \frac{\sqrt{3}}{1}$

**(27) Answer :** (3)
**Solution:**
$A_1v_1 = A_2v_2 + A_3v_3$

$\therefore\ v_3 = \frac{A_1v_1 - A_2v_2}{A_1} = 1$ m/s

**(28) Answer :** (1)
**Solution:**

$T(x) = \frac{m\omega^2}{2\ell}(l - x)^2$







If *dl* is elongation in length *dx* of rod at distance *x* from axis of rotation, then

$= \frac{dl}{dx} = \frac{T(x)}{AY}$

$\Delta l = \int \frac{T\,dx}{AY} = \int_0^\ell \frac{m\omega^2(\ell - x)^2}{2\ell AY} dx$

$= \Rightarrow \Delta\ell = \frac{m\omega^2}{LAY} \times \frac{L^3}{3} = \frac{m\omega^2 L^2}{3AY} = \frac{\rho\omega^2 L^3}{3Y}$

**(29) Answer :** (1)
**Solution:**
$V_T = \frac{2}{9} \times \frac{a^2}{\eta} \times \left[\sigma - \rho\right] \times g$ , i.e. if density of body increases, then terminal velocity increases.

**(30) Answer :** (1)
**Solution:**
$h = \frac{2 s\cos\theta}{\rho g h}$
$h \propto \frac{1}{r}$
$\frac{h}{h_1} = \frac{r}{2r}$
$h_1 = 2h$

**(31) Answer :** (3)
**Solution:**
$\frac{1}{2}v^2 = \frac{P_1 - P_2}{\rho}$
$\Rightarrow \frac{1}{2}v^2 = \frac{0.1 \times 10^6}{1000}$
$\Rightarrow \frac{1}{2}v^2 = 100$
$\Rightarrow v = \sqrt{200} = 10\sqrt{2}$ m/s

**(32) Answer :** (3)
**Solution:**
Terminal speed $v \propto r^2$
Viscous force $F = 6\pi\eta rv$
$\Rightarrow F \propto r^3$
So ratio of drag force = 8 : 27.

**(33) Answer :** (3)
**Solution:**
For floatation in water
$V\rho_{body}g = \left(\frac{h}{2} \times A\right)\rho_{water}g$ ...(1)
(Where V is volume of body and A is circular cross sectional area of cylinder)
For floatation in oil
$V\rho_{body}g = \left(\frac{h}{4} \times A\right)\rho_{oil}g$ ...(2)
From (1) and (2)
$\frac{1}{2}\rho_w = \frac{1}{4}\rho_{oil}$
$\rho_{oil} = 2\rho_w$
$= 2 \times 1000$
$= 2000$ kg/m$^3$
$= 2$ gm/cm$^3$

**(34) Answer :** (1)
**Solution:**
**Hint:** $R = 2\sqrt{h(H-h)}$
**Solution:** $R = 2\sqrt{h(H-h)}$
$R_{max} = H = 2h$
$10 = 2h \Rightarrow h = 5$ m.

**(35) Answer :** (2)
**Solution:**
Bernoulli's equation is based on conservation of energy principle

**(36) Answer :** (1)
**Solution:**
$P_A + \rho_{gh} - \rho_{gh} = P_B \Rightarrow P_A - P_B = 0$

**(37) Answer :** (3)
**Solution:**
From equation of continuity

$A_1 v_1 = A_2 v_2$

$\Rightarrow \frac{A_1}{A_2} = \frac{v_2}{v_1} = 3$

$\Rightarrow \frac{{r_1}^2}{{r_2}^2} = 3 \Rightarrow \frac{r_1}{r_2} = \sqrt{3} : 1$

**(38) Answer :** (4)
**Solution:**

$27 \times \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3 \quad S_{\text{large}} = 4\pi R^2$

$R = 3r \Rightarrow r = \frac{R}{3} \quad S_{\text{small}} = 4\pi r^2$

Total initial surface area

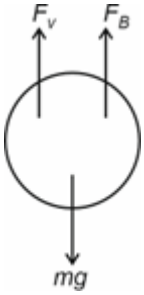
$= 27 \cdot 4\pi r^2 = 27 \cdot 4\pi \cdot \frac{R^2}{9} = 3 \cdot 4\pi R^2 = 12\pi R^2$

Total final surface area = $4\pi R^2$

∴ Decrease in area = $8\pi R^2$

∴ Loss in surface energy = $S \times 8\pi R^2$

**(39) Answer :** (3)
**Solution:**
At terminal velocity




$F_V + F_B = mg$

**(40) Answer :** (4)
**Solution:**

$v = \sqrt{v_x^2 + v_y^2} = \sqrt{2 \times 10 \times 5 + 2 \times 10 \times 15}$

$= \sqrt{100 + 300}$

= 20 m/s

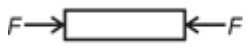
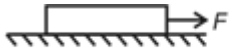
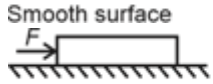
**(41) Answer :** (2)
**Solution:**
The **assertion** that adding detergent to water decreases its surface tension is true. Detergents reduce the cohesive forces between water molecules, thereby lowering the surface tension. The **reason** that surface tension has the same dimension as force per unit length is also true, as surface tension is defined as the force per unit length acting along the surface of a liquid. However, the reason does not explain why the surface tension decreases when detergent is added. Therefore, the correct answer is (2): Both Assertion & Reason are true but the reason is not the correct explanation of the assertion.

**(42) Answer :** (1)
**Hint:**
The liquid has acceleration at the bend and the direction of acceleration is south west. This acceleration is due to the force exerted by the pipe on the liquid. Hence the direction of the force exerted by the liquid on the pipe is North East.

**(43) Answer :** (2)
**Solution:**
When four water droplets combine to form a larger droplet, the total surface area decreases. A decrease in surface area leads to a release of surface energy. Therefore, **energy is released**.

**(44) Answer :** (3)
**Solution:**
Breaking stress is the property of material and breaking strength equals breaking stress × area of cross-section

**(45) Answer :** (3)
**Solution:**

-  Uniform compressive stress in the rod
-  Uniform tensile stresses in the rod
-  Non uniform tensile stresses in the rod
- Smooth surface
-  Non uniform compressive stresses in the rod
- Smooth surface

**CHEMISTRY**

**(46)** **Answer :** (3)
**Solution:**
Work done during a cyclic process is area of process in PV graph.

**(47)** **Answer :** (2)
**Hint:**
$q = nC_P\Delta T$
**Solution:**
$q = 2 \times 20 \times 100$
$q = 4000$ J

**(48)** **Answer :** (2)
**Hint:**
State function depends only on the state i.e. on initial and final position does not depends on the path followed.
**Solution:**
q and W are the path functions.

**(49)** **Answer :** (1)
**Hint:**
For enthalpy change $\Delta H = nC_P\Delta T$
**Solution:**
For isothermal process temperature remains constant therefore $\Delta T = 0$
$\therefore \Delta H = nC_P\Delta T = 0$

**(50)** **Answer :** (4)
**Hint:**
Using first law of thermodynamics,
$dU = q + W$
**Solution:**
for free expansion; $P_{ext} = 0$,
Hence $W = 0$
Using $q = 0$ (for adiabatic process)
$\Delta U = q + W$
So, $\Delta U = 0$

**(51)** **Answer :** (1)
**Hint:**
Neutralisation reaction of strong acids with strong bases release maximum heat.
**Solution:**
HF is strong acid and hydration of $F^-$ is maximum hence it gives maximum heat of neutralisation.

**(52)** **Answer :** (2)
**Hint:**
Relation between heat capacity at constant volume ($C_v$) and heat capacity at constant pressure ($C_p$) is defined by $C_p - C_v = nR$
**Solution:**
$C_p - 20.7 = 2 \times 8.314$
$C_p = (2 \times 8.314) + 20.7$
$C_p = 37.328$ J/K

**(53)** **Answer :** (1)
**Solution:**
q = +ve; heat is transferred from surrounding to system.
W = +ve; work is done on the system.
$\Delta H_r$ = –ve; represents exothermic reaction *i.e.* release in energy.

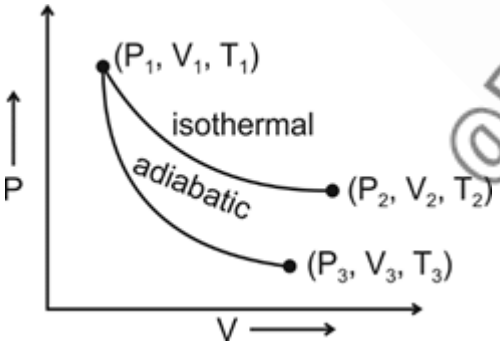
**(54)** **Answer :** (2)
**Hint:**
Using first law of thermodynamics
$\Delta U = q + w$
**Solution:**
q = –80 J
$\Delta U$ = 100 J
Using $\Delta U = q + w$
100 = –80 + w
w = 180 J

**(55)** **Answer :** (3)
**Hint:**
For cyclic process, the change in state functions are zero.
**Solution:**
$\Delta H$, $\Delta S$ and $\Delta U$ are state functions:
Hence, for cyclic process, $\Delta H = 0$
$\Delta S = 0$
$\Delta U = 0$

**(56)** **Answer :** (3)
**Hint:**
The properties which do not depend on the quantity or size of matter present are known as intensive properties.
**Solution:**
Molar volume, molarity, temperature, density, pressure, etc. are intensive properties.

**(57)** **Answer :** (4)
**Solution:**
For adiabatic process
q = 0
hence $\Delta U = W$

**(58)** **Answer :** (3)
**Solution:**




$\therefore w_{isothermal} > w_{adiabatic}$

**(59)** **Answer :** (3)
**Solution:**
During reversible adiabatic expansion of an ideal gas, cooling takes place.
$\therefore \Delta S_{isothermal} > \Delta S_{adiabatic}$
$\Delta S = \frac{q}{T}$; for adiabatic process; q = 0

**(60)** **Answer :** (2)
**Solution:**
The process is adiabatic hence, q = 0
The process is irreversible hence
$w = -P\Delta V$
$= -3 \times (8.7 - 4.2)$
$= -3 \times 4.5 = -13.5$ L-atm

$\Delta U = q + w$
$\Delta U = w$ [$\because q = 0$]
$\Delta U = -13.5 \times 101.3 = -1.367$ kJ

**(61) Answer :** (2)
**Solution:**
Pressure ⇒ Intensive property
Heat capacity = Extensive property
q & w are path function

**(62) Answer :** (3)
**Solution:**
For free expansion w = 0
For adiabatic process q = 0
hence $\Delta U = q + w = 0$

**(63) Answer :** (1)
**Hint:**
The enthalpy change that occurs when one mole of the substance is formed from its constituent elements in their standard states is enthalpy of formation.
**Solution:**
$C(\text{graphite}) + O_2(g) \rightarrow CO_2(g)$ ...(i), $\Delta_r H° = -393.5$ kJ mol$^{-1}$
$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ ...(ii), $\Delta_r H° = -285.8$ kJ mol$^{-1}$
$CO_2(g) + 2H_2O(l) \rightarrow CH_4(g)$ ...(iii), $\Delta_r H° = +890.3$ kJ mol$^{-1}$
(i) + 2 × (ii) + (iii) we have,
$C(\text{graphite}) + 2H_2(g) \rightarrow CH_4(g)$
$\Delta_r H° = -393.5 + 2(-285.8) + 890.3$
$= -74.8$ kJ/mol

**(64) Answer :** (1)
**Solution:**
$$n_{C_4H_{10}} = \frac{w_{C_4H_{10}}}{m_{C_4H_{10}}} = \frac{5.8}{58} = 0.1 \text{ mol}$$
Heat released during combustion
$= n_{c_4H_{10}} \times 2658 \text{ kJ} = 265.8 \text{ kJ}$

**(65) Answer :** (2)
**Hint:**
Enthalpy of neutralisation is the amount of energy released when one mole of $H_2O$ is produced from the reaction of acid and base.
**Solution:**
$$HA + BOH \rightleftharpoons BA + H_2O$$
$t = 00.20 \;\; 0.10$
$t = t0.10 \;\; - \;\; 0.10 \;\; 0.10$
There is a neutralisation of 0.10 moles or we can say that 0.10 moles of $H_2O$ is produced.
So, enthalpy of neutralisation = $-57.1 \times 0.10$ kJ
$= -5.71$ kJ

**(66) Answer :** (3)
**Solution:**
$$\Delta_{sol}^{H} = \Delta H_{(\text{lattice})} + \Delta H_{(\text{hydration})}$$
$$\Delta_{sol} H = 788 - 780 = +8 \text{ kJ mol}^{-1}$$

**(67) Answer :** (2)
**Hint:**
$\Delta H_r = \Sigma$ (Bond enthalpy of reactants) $-\Sigma$ (Bond enthalpies of products)
**Solution:**
Let x is the bond energy of N–H bond
$-91.8 = 946 + 3(435) - (2 \times 3 \times x)$
$x = 390$ kJ mol$^{-1}$

**(68) Answer :** (2)
**Hint:**

Increase in disorderness leads to increase in entropy.

**Solution:**

Entropy increases during boiling of egg because of denaturation of protein.

$H_2(g) \rightarrow 2H(g)$

Entropy increases because number of gaseous moles increases.

**(69)** **Answer :** (3)

**Hint:**

Combustion reactions are exothermic reactions.

**Solution:**

$H_2O \rightarrow H_2 + \frac{1}{2}O_2,$ Endothermic


**(70)** **Answer :** (3)

**Solution:**

$C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

$\Delta_r H = 2\ \Delta_f H\{CO_2(g)\} + 3\ \Delta_f H\{H_2O(l)\} - \Delta_f H\{C_2H_6(g)\}$

$= 2 \times (-90) + 3 \times (-70) - (-20)$

$= -180 - 210 + 20$

$= -370$ kcal mol$^{-1}$

**(71)** **Answer :** (4)

**Hint:**

$\Delta G$ is the net energy available to do useful work.

**Solution:**

$T\Delta S_{system}$ is the energy which is not available to do useful work

**(72)** **Answer :** (2)

**Hint:**

$\Delta G$ gives the criteria for spontaneity at constant temperature and pressure.

**Solution:**

For endothermic reactions, $\Delta H$ = +ve;

$\Delta G = \Delta H - T\Delta S$

At very high temperature $|T\Delta S| > |\Delta H|$; making $\Delta G$ = –ve. Hence, spontaneous.

**(73)** **Answer :** (3)

**Hint:**

For spontaneous reaction, $\Delta G$ must be negative.

**Solution:**

$\Delta G = \Delta H - T\Delta S$

For spontaneous $\Delta G$ = –ve

$\Delta H - T\Delta S < 0$

$\Delta H < T\Delta S$

$\frac{\Delta H}{\Delta S} < T$

$T > \frac{40000}{60}$

T > 666.6 K

**(74)** **Answer :** (4)

**Hint:**

Heat added to the system can influence molecular motions and hence randomness.

**Solution:**

As entropy is inversely proportional to the temperature $\Delta S = \frac{q_{rev}}{T}$,

so, at low temperature, there is more randomness caused when heat is added to system.

**(75)** **Answer :** (2)

**Hint:**

The entropy of a perfectly crystalline solids or perfect crystal is defined by the third law of thermodynamics.

**Solution:**

The entropy of perfect crystal at absolute zero temperature is zero.

**(76)** **Answer :** (1)

**Hint:**

$\Delta G = \Delta H - T\Delta S$

**Solution:**
$\Delta G = \Delta H - T\Delta S$
As $\Delta n_g = 0$
$\Delta H = \Delta U = 5$ kcal
$\Delta G = 5 - 300 \times 50 \times 10^{-3}$
$= 5 - 15$
$= -10$ kcal

**(77)** **Answer :** (3)
**Hint:**
Entropy change of a reversible process can be calculated using $\Delta S_{sys} = \frac{q_{sys,rev}}{T}$
**Solution:**
For ideal gas in isothermal conditions $\Delta S_{sys} = nR\, ln\frac{V_2}{V_1}$
$\Delta S = 3 \times 2\, In\frac{5}{0.5}$
$\Delta S = 6 \ln 10$
$\Delta S = 6 \times 2.303 \times \log 10$
$\Delta S = 13.818$ cal $K^{-1}$

**(78)** **Answer :** (2)
**Solution:**
$\Delta S = \frac{\Delta H}{T}$
$\Delta H = 300 \times 100$
$= 30$ kJ $mol^{-1}$

**(79)** **Answer :** (2)
**Solution:**
· Heat and work are path functions.
· At equilibrium, change in entropy $\Delta S = 0$, and entropy is maximum.

**(80)** **Answer :** (3)
**Hint:**
$\Delta U = q + w$
For isobaric process, $q_P = \Delta H = nC_p\Delta T$.
**Solution:**
$\Delta H = nC_p\Delta T$
For monoatomic gas
$C_p = \frac{5}{2}R$ , $C_v = \frac{3}{2}R$
$\Delta H = 1 \times \frac{5}{2}R \times 50 = 1039.25\ J$
As $\frac{C_p}{C_v} = \gamma = \frac{5}{3} = 1.67$
$\frac{\Delta H}{\Delta U} = \gamma$
$\Rightarrow \Delta U = \frac{\Delta H}{\gamma} = \frac{1039.25}{1.67} = 622.3\ J$

**(81)** **Answer :** (1)
**Hint:**
$\Delta H = \Delta U + \Delta(PV)$
**Solution:**
$\Delta H = \Delta U + n_g R\Delta T$
$10 = \Delta U + (2 \times 2 \times 1)$
$\Rightarrow \Delta U = 6$ cal

**(82)** **Answer :** (2)
**Solution:**
In adiabatic process, heat exchange is zero.

**(83)** **Answer :** (3)
**Solution:**
$\Delta U = q + w = -20 + (-40) = -60$ J

**(84)** **Answer :** (1)
**Hint:**

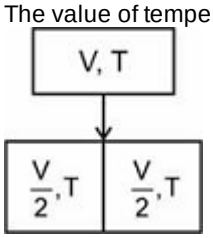
Heat at constant volume = ΔU
Heat at constant pressure = ΔH
**Solution:**
$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$
$\Rightarrow \Delta H = \Delta U + \Delta n_g RT$
$\Rightarrow \Delta n_g = 3 - 3 = 0$
$\therefore \Delta H = \Delta U + 0 \times R \times T$
$\Delta H = -20$ kJ

**(85)** **Answer :** (2)
**Solution:**
$\Delta H(kJ\ mol^{-1})$
$\left(\frac{1}{2}A \rightarrow B\right) \times 2 \ \Delta H = -200$
$3B \rightarrow 2C + D \quad \Delta H = +120$
$2D \rightarrow E + A \quad \Delta H = +325$
ΔH for B + D → E + 2C
$= (-200 + 120 + 325)\ kJ\ mol^{-1}$
$= +245\ kJ\ mol^{-1}$

**(86)** **Answer :** (2)
**Solution:**
Mean C – H bond enthalpy = $\frac{1665}{4}$
$= 416.25\ kJ\ mol^{-1}$

**(87)** **Answer :** (3)
**Hint:**
Molar heat capacity = $\frac{1}{n}\frac{dQ}{dT}$
**Solution:**
For isothermal process, dT = 0
So, molar heat capacity will be infinite.

**(88)** **Answer :** (4)
**Hint:**
An intensive property is the property whose value does not depend on the quantity present in the system.
**Solution:**
The value of temperature does not depend on amount of substance.




Temperature is an intensive property.

**(89)** **Answer :** (3)
**Hint:**
$\Delta H = \Delta U + \Delta n_g RT$
**Solution:**
$\Delta H - \Delta U = \Delta n_g RT$
$2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$
$\Delta n_g = -3$
$\Delta H - \Delta U = \frac{-3 \times 8.314}{1000} \times 298 = -7.43 \ \ kJ$

**(90)** **Answer :** (2)
**Solution:**
$\Delta G = \Delta H - T\Delta S$, if ΔH > 0 and ΔS < 0 then ΔG of system is always positive so reaction is always non spontaneous.

**BOTANY**

**(91) Answer :** (2)
**Hint:**
Colchicine producing plant belongs to family Liliaceae.
**Solution:**
Liliaceae has tricarpellary superior ovary.

**(92) Answer :** (1)
**Hint:**
Perianth is found in the members of Liliaceae family.
**Solution:**
Tulip being a member of Liliaceae family, has perianth.

**(93) Answer :** (2)
**Hint:**
Flower with superior ovary is hypogynous.
**Solution:**
When female reproductive part occupies highest position then flower is called hypogynous with superior ovary.

**(94) Answer :** (4)
**Solution:**
*Aloe* is a member of Liliaceae family. In Liliaceae family, leaves are mostly basal, alternate, linear, exstipulate with parallel venation.

**(95) Answer :** (2)
**Solution:**
In racemose inflorescence, the terminal flower is absent.
It (main axis) has unlimited growth and flowers are borne in acropetal manner.

**(96) Answer :** (3)
**Solution:**
Fused carpels condition is syncarpous condition.

**(97) Answer :** (4)
**Solution:**
Answer (4)
Adventitious roots arise from a part other than radicle.

**(98) Answer :** (3)
**Solution:**
Venation – Arrangement of veins and veinlets in the lamina of leaf.
Phyllotaxy – Pattern of arrangement of leaves on stem or branch.
Arrangement of flowers on floral axis is termed as inflorescence.

**(99) Answer :** (4)
**Solution:**
Flower is a modified shoot. When the apical shoot meristem changes to floral meristem then the shoot bears flowers.

**(100) Answer :** (3)
**Hint:**
*Euphorbia* inhabits arid regions.
**Solution:**
In *Euphorbia,* stems are modified into fleshy cylindrical structures.
Axillary buds of stems get modified into woody, straight and pointed thorns *e.g.*, Citrus.
Stem tendrils which develop from axillary buds, are slender and spirally coiled *e.g.*, Cucumber.
In plants like mint and jasmine, a slender lateral branch arises from the base of the main axis and after growing aerially for some time arch downwards to touch the ground.

**(101) Answer :** (3)
**Hint:**
Aleurone layer is a proteinaceous layer.
**Solution:**
In monocot seeds (Maize), the outer covering of endosperm separates the embryo by a proteinaceous layer called aleurone layer.
The root is covered at the apex by a thimble-like structure called the root cap.

**(102) Answer :** (2)
**Solution:**
The calyx is the outermost whorl of the flower and the members are called sepals. Generally, sepals are green, leaf like and protect the flower in the bud stage.

**(103) Answer :** (3)
**Solution:**
Parthenocarpic fruits are seedless.

**(104) Answer :** (3)
**Hint:**
Adhesion is denoted by a line drawn above the symbols of the floral parts.
**Solution:**
Fusion is indicated by enclosing the figure within bracket. 'Br' stands for bracteate condition.

**(105) Answer :** (1)
**Solution:**
Direct elongation of radicle forms primary root in dicots. It later gives rise to secondary and tertiary roots (lateral).

**(106) Answer :** (3)
**Solution:**
Absorption of minerals and water is the main function of roots.

**(107) Answer :** (2)
**Solution:**
Ashwagandha belongs to Solanaceae family and show bicarpellary, syncarpous, superior ovary with swollen placenta.

**(108) Answer :** (1)
**Hint:**
In legumes, monocarpellary gynoecium is found.
*Datura* belongs to Solanaceae family.
**Solution:**
*Citrus* bears polyadelphous stamens.
Pea flower has monocarpellary gynoecium.
*Datura* has axile placentation.
*Salvia* flower has stamens of different length within a flower.

**(109) Answer :** (2)
**Solution:**
The given floral diagram belongs to liliaceae family members i.e., *Allium cepa* with epitepalous androecium and perianth having valvate aestivation.
The given floral diagram can be represented by

$$Br \oplus \varphi \; \overset{\frown}{P_{(3+3)}} \; A_{3+3} \; \underline{G}_{(3)}$$

floral formula.

**(110) Answer :** (2)
**Solution:**
The features associated with the China rose plant are: **alternate phyllotaxy**, **monoadelphous stamens**, and **axile placentation**. However, the China rose has twisted aestivation, not valvate aestivation. Therefore, three of the given features are associated with the China rose plant. The correct answer is **(2) Three**.

**(111) Answer :** (4)
**Hint:**
In pinnately compound leaf, leaflets are present on a common axis.
**Solution:**
The common axis on which many leaflets are attached, represents the midrib of the pinnately compound leaf.

**(112) Answer :** (3)
**Solution:**
Baryan tree have prop roots.
Tap root is usually present in dicot.
Root can modify tram selves for several purposes e.g. respiration, storage of food.
Pneumatophores are also called respiratory roots.

**(113) Answer :** (2)

**Solution:**
*Alstonia* has whorled phyllotaxy. The leaves in this plant are simple.

**(114) Answer :** (2)
**Solution:**
Mustard has hypogynous flower in which ovary/gynoecium occupies the highest position while other parts are situated below it.

**(115) Answer :** (3)
**Solution:**
Papilionaceous corolla is present in the flowers of family Fabaceae. In these flowers, the posterior petal is the largest one.

**(116) Answer :** (1)
**Solution:**
Thorns are modified axillary buds. These structures are found in *Bougainvillea*.

**(117) Answer :** (3)
**Solution:**
Carrot & Turnip are modifications of tap root.
Ginger is a modified underground stem. Edible part of sweet potato is a modified adventitious root.

**(118) Answer :** (3)
**Hint:**
Pitcher in pitcher plant is modified structure of leaf.
**Solution:**
Lamina forms pitcher in pitcher plant.

**(119) Answer :** (2)
**Solution:**
In *Aloe* leaf modify into spines.

**(120) Answer :** (2)
**Hint:**
When sepals or petals overlap one another but not in any particular direction, the aestivation is called imbricate.
**Solution:**
China rose, lady's finger and cotton show twisted aestivation of sepals or petals. Pea is an example of vexillary aestivation.

**(121) Answer :** (2)
**Solution:**
Root cap protects the tender apex of the root as it makes its way through the soil. Root hairs absorb water and minerals from the soil.

**(122) Answer :** (2)
**Hint:**
When the oldest flower is present at the top and youngest at the bottom, then it is basipetal order.
**Solution:**
In cymose type of inflorescence, the main floral axis (peduncle) terminates in a flower, hence is limited in growth.

**(123) Answer :** (3)
**Hint:**
When the primary root is short lived and is replaced by a large number of roots which originate from the base of the stem, then they constitute fibrous root system.
**Solution:**
Fibrous root system is a characteristic feature of monocots. Wheat is a monocot plant while mustard plant, mango tree and banyan tree are dicots.

**(124) Answer :** (1)
**Solution:**
Pore found above hilum is known as micropyle.

**(125) Answer :** (2)
**Solution:**
In monocot seeds seed coat is fused with pericarp i.e. maize.

**(126) Answer :** (3)
**Solution:**
*Solanum nigrum* belongs to Solanaceae family. It has epipetalous androecium, syncarpous gynoecium and flower shows actinomorphic symmetry.

**(127) Answer :** (3)

**Hint:**
The hilum is a scar on the seed coat through which the developing seeds were attached to the fruit.
**Solution:**
Nucellus remains persistent in some seeds called perisperm.

**(128) Answer :** (1)
**Solution:**
*Allium cepa* belongs to the family Liliaceae. In this plant, flowers have six (3 + 3) tepals and six stamens are epitepalous.

**(129) Answer :** (3)
**Solution:**
The given figure is of free central placentation. Examples are *Primrose* and *Dianthus*.

**(130) Answer :** (1)
**Solution:**
In *Asparagus*, the flowers are actinomorphic, hypogynous and bisexual.

**(131) Answer :** (3)
**Solution:**
Epigynous flowers are found in ray florets of sunflower. Rose and peach have perigynous flowers. Brinjal has hypogynous flowers.

**(132) Answer :** (2)
**Solution:**
Leaf base bears two lateral, small leaf like structures called stipules. Pulvinus is found in leguminous plants.

**(133) Answer :** (3)
**Solution:**
Edible part of mango is middle fleshy mesocarp.

**(134) Answer :** (1)
**Solution:**
A flower is asymmetric, if it cannot be divided into two similar halves by any vertical plane passing through the centre, as in canna.

**(135) Answer :** (4)
**Hint:**
In banana and pineapple, the lateral branches originate from the basal and underground portion of the main stem.
**Solution:**
In *Pistia* and *Eichhornia,* a lateral branch with short internodes and each node bearing a rosette of leaves and tuft of roots is found. They are aquatic plants.

**ZOOLOGY**

**(136) Answer :** (3)
**Solution:**
The proximity between the Henle's loop and vasa recta, as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium, *i.e*., from 300 mOsmol $L^{-1}$ in the cortex to about 1200 mOsmol $L^{-1}$ in the inner medulla. This gradient is mainly caused by NaCl and urea.

**(137) Answer :** (4)
**Solution:**
The Malpighian corpuscle, PCT and DCT of the nephron are present in the cortical region of the kidney. In majority of the nephrons, the loop of Henle is too short and extends only very little into the medulla. Such nephrons are called cortical nephrons. In some of the nephrons, the loop of Henle is very long and runs deep into the medulla. These nephrons are called juxta medullary nephrons.

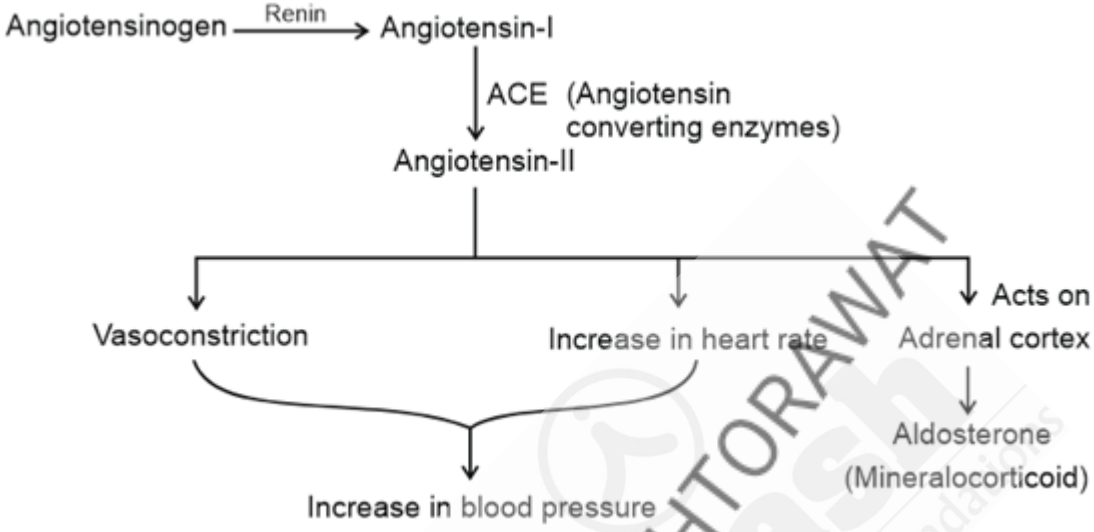
**(138) Answer :** (3)
**Solution:**
Aldosterone helps in the maintenance of electrolytes, body fluid volume, osmotic pressure and blood pressure.
ADH can also affect the kidney functions by its constrictory effect on blood vessels that causes an increase in blood pressure.
Epinephrine also increases blood pressure.
ANF can cause vasodilation that decrease the blood pressure.

**(139) Answer :** (2)

**Solution:**
Protonephridia or flame cells are the excretory structures in platyhelminths (flatworms, *e.g. Planaria*).
Green glands or antennal glands are found in prawns.

**(140) Answer :** (1)
**Solution:**
The fluid entering the proximal tubule of the nephron, known as the glomerular filtrate, has an osmolarity similar to that of the plasma. Subsequent reabsorption and secretion processes in the renal tubules contribute to alternations in the composition and osmolarity of the urine.

**(141) Answer :** (4)
**Hint:**
JGA secretes renin in response to fall in GFR.
**Solution:**
Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR.




ACE is produced by endothelial cells of lung capillaries.

**(142) Answer :** (4)
**Solution:**
Reptiles, birds, land snails and insects excrete nitrogenous wastes as uric acid in the form of pellet or paste with a minimum loss of water and are called uricotelic animals. Mammals are ureotelic.

**(143) Answer :** (2)
**Hint:**
Also assists in movement of human spermatozoa
**Solution:**
Skeletal muscles – Involved in locomotory actions and changes of body postures.
Flagellar movement helps in maintenance of water current in the canal system of sponges and in the locomotion of *Euglena*.
Ciliary movement assists in movement of ova through female reproductive tract.

**(144) Answer :** (4)
**Solution:**
In an adult human, each kidney measures 10 – 12 cm in length, 5 – 7 cm in width, 2 – 3 cm in thickness with an average weight of 120 –170 gm. Kidneys are situated between the levels of last thoracic and third lumbar vertebra close to the dorsal inner wall of the abdominal cavity.

**(145) Answer :** (4)
**Solution:**
Artificial kidney (dialysing unit) contains a coiled cellophane tube surrounded by a fluid (dialysing fluid) having the same composition as that of plasma, except the nitrogenous wastes.

**(146) Answer :** (1)
**Solution:**
Reabsorption of $Na^+$ and $Cl^-$ and secretion of $H^+$ and $K^+$ ions by collecting duct helps in maintenance of blood pH and ionic balance.

**(147) Answer :** (2)

**Hint:**
Large amount of $CO_2$ is removed by lungs.
**Solution:**
Our lungs remove approximately 200 ml/min of $CO_2$ along with significant quantities of water per day.

**(148) Answer :** (4)
**Solution:**
Urine formed by the nephrons is ultimately carried to the urinary bladder where it is stored till a voluntary signal is given by the central nervous system (CNS). This signal is initiated by the stretching of the urinary bladder as it gets filled with urine.

**(149) Answer :** (3)
**Solution:**
Animals accumulate ammonia, urea, uric acid, $CO_2$, water and ions like $Na^+$, $K^+$, $Cl^-$, phosphate, sulphate, *etc*., either by metabolic activities or by other means like excess ingestion. Ammonia, as it is readily soluble, is generally excreted by diffusion across body surfaces or through gill surfaces (in fish) as ammonium ions. Kidneys do not play any significant role in its removal.

**(150) Answer :** (2)
**Solution:**
Ammonotelic – Bony fishes, aquatic amphibians, aquatic insects.
Ureotelic – Mammals, many terrestrial amphibians, marine fishes.
Uricotelic – Reptiles, birds, land snails and insects
Increasing order of toxicity – Uric acid < Urea < Ammonia

**(151) Answer :** (1)
**Hint:**
Urinary bladder contains muscles that have spindle-shaped muscle fibres.
**Solution:**
The CNS passes on motor messages to initiate the contraction of smooth muscles of the urinary bladder and simultaneous relaxation of the urethral sphincters causing the release of urine. The process of release of urine is called micturition.

**(152) Answer :** (2)
**Hint:**
Eliminate the substance removed by the largest gland in the human body.
**Solution:**
Sweat contains NaCl, small amounts of urea, lactic acid, *etc*.
Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum.

**(153) Answer :** (4)
**Hint:**
Protons are secreted in DCT.
**Solution:**
Selective secretion of $H^+$ occurs in PCT and DCT, which is important in maintaining acid/base balance.
$Na^+/H^+$ antiporter is found at the apical surface of PCT cells.

**(154) Answer :** (4)
**Solution:**
A motor neuron along with the muscle fibres connected to it constitute a motor unit.

**(155) Answer :** (3)
**Hint:**
Renal tubule is involved in tubular secretion.
**Solution:**
Glomerulus is involved in ultrafiltration of blood plasma. Reabsorption and tubular secretion take place in renal tubules.

**(156) Answer :** (3)
**Hint:**
Accumulation of nitrogenous waste in fluid lacking bile pigments.
**Solution:**
Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia.

**(157) Answer :** (3)
**Solution:**
In haemodialysis, blood is mixed with anticoagulant like heparin and anti-heparin is added when it is returned to body of patient.

**(158) Answer :** (2)
**Solution:**

ADH has constrictory effects on blood vessels. Renin converts angiotensinogen in blood to angiotensin I. ANF is a vasodilator.

**(159) Answer :** (2)
**Solution:**
The Malpighian corpuscle, PCT and DCT of the nephron are situated in the cortical region of the kidneys whereas the loop of Henle dips into the medulla. In some of the nephrons, the loop of Henle is very long and runs deep into the medulla. These nephrons are called juxta medullary nephrons.

**(160) Answer :** (2)
**Solution:**
Constriction of renal arteries causes decrease in renal blood flow as well as GFR.

**(161) Answer :** (1)
**Solution:**
Kidneys are responsible for the production of urine. Each kidney has 1 million complex tubular structures called nephrons. Average weight of each kidney is 120-170 gm.

**(162) Answer :** (3)
**Solution:**
The globular head of meromyosin possesses binding sites for ATP and actin.

**(163) Answer :** (3)
**Hint:**
Pseudopodia is present
**Solution:**
Pseudopodia is formed by streaming of protoplasm (as in *Amoeba*). Flagellar movement helps in the swimming of spermatozoa, maintenance of water current in the canal system of sponges and locomotion of protozoans like *Euglena.*

**(164) Answer :** (4)
**Solution:**
The portion of myofibril between two successive 'Z' lines is considered as the functional unit of contraction and is called a sarcomere.

**(165) Answer :** (2)
**Solution:**
Some specialised cells in our body like macrophages and leucocytes exhibit amoeboid movement. Ciliary movement occurs in most of our internal tubular organs which are lined by ciliated epithelium. Cilia are present in trachea. Flagellar movement helps in swimming of spermatozoa in the oviduct. Muscular movement is exhibited by skeletal muscles of limbs.

**(166) Answer :** (3)
**Hint:**
Similar to origin of the heart
**Solution:**
About 40-50 per cent of the body weight of a normal human adult is contributed by muscles. Muscles are mesodermal in origin with few exceptions like ciliary muscles of eye.

**(167) Answer :** (3)
**Hint:**
Muscle bundles are also known as fascicles.
**Solution:**
Each organised skeletal muscle in our body is made of a number of muscle bundles or fascicles held together by a common collagenous connective tissue layer called fascia.
A characteristic feature of the muscle fibre is the presence of a large number of parallelly arranged filaments in the sarcoplasm called myofilaments or myofibrils.

**(168) Answer :** (1)
**Hint:**
Ability to respond to stimulus is termed as excitability.
**Solution:**
Muscles have special properties like excitability, contractility, extensibility and elasticity.
Myelination is present in certain neurons.

**(169) Answer :** (3)
**Hint:**
Visceral muscles are also known as smooth muscles.
**Solution:**
Visceral muscle fibres are non-striated, uninucleated, involuntary and unbranched.
Skeletal muscle fibres are multinucleated, striated and unbranched.

**(170) Answer :** (1)
**Solution:**
Sarcoplasmic reticulum is the store house of $Ca^{2+}$.

**(171) Answer :** (2)
**Solution:**
**Sarcolemma :** Plasma membrane of the muscle fibre
**Sarcoplasma :** Cytoplasm of muscle fibre
**Sarcoplasmic Reticulum :** Endoplasmic reticulum of the muscle fibre.
**Syncytial :** A cell having multiple nuclei assumed to be formed by fusion.

**(172) Answer :** (3)
**Hint:**
ATPase location
**Solution:**
The globular head of myosin is an active ATPase enzyme and has binding sites for ATP and active site for actin. Utilising the energy of ATP hydrolysis, the myosin head binds to exposed sites on actin to form a cross bridge

**(173) Answer :** (2)
**Solution:**
Skeletal muscle fibers contain many nuclei at periphery. Red muscle fibers have more mitochondria and myoglobin content.

**(174) Answer :** (2)
**Solution:**
Regulatory protein – Troponine, Tropomyosin
Structural protein – Dystrophin
Contractile protein – Actin, Myosin

**(175) Answer :** (1)
**Solution:**
Monomeric protein of F-actin is G-actin and monomeric protein of thick filament (myosin) is meromyosin.

**(176) Answer :** (2)
**Solution:**
Smooth muscles have non-striated and involuntary muscles fibres and in the wall of genitat tract smooth muscles are present.

**(177) Answer :** (2)
**Solution:**
In a sarcomere, Z-line bisects 'I' band whereas thick filaments in the 'A' band are held together in the middle by a thin fibrous membrane called M-line.
In the centre of each 'I' band is an elastic fibre called 'Z' line which bisects it.

**(178) Answer :** (1)
**Solution:**
In the human body, there are three types of muscles: skeletal, smooth, and cardiac.
**Skeletal Muscle:** Skeletal muscle, attached to bones, is responsible for skeletal movements. These muscles are under conscious or voluntary control. Their muscle fibres have many peripherally placed nuclei. The muscle fibres are cylindrical, striated and unbranched with blunt ends.
**Cardiac Muscle:** Cardiac muscle, found in the walls of the heart, is under the control of the autonomic nervous system. The cardiac muscle cell has one central nucleus, like smooth muscle, but it is also cylindrical and striated, like skeletal muscle. The contraction of cardiac muscle is involuntary, strong, and rhythmical. The muscle fibres are branched.

**(179) Answer :** (2)
**Solution:**
'A' band has both actin and myosin filaments and 'H-zone has only myosin filaments in the relaxed state.

**(180) Answer :** (2)
**Hint:**
Anaerobic breakdown of glycogen.
**Solution:**
During strenuous exercise, glycogen is anaerobically metabolized to produce lactic acid. Creatine phosphate is broken down to produce ATP for muscle contraction. So, both ADP and lactic acid increases in muscles.