23/07/2025

Code-B_(Phase-2)

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-02B

**Time : 180 Min.**

## PHYSICS

**1.** (2)
**2.** (4)
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**45.** (1)



## CHEMISTRY

**46.** (3)
**69.** (2)

**47.** (1)
**48.** (3)
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## BOTANY

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## ZOOLOGY

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**179.** (3)

**157.** (4)

**158.** (2)

**180.** (3)

## Hints and Solutions

### PHYSICS

**(1)** **Answer :** (2)
**Solution:**
Equation of trajectory of a projectile:
$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$
Given $y = \sqrt{3}x - 5x^2$
On comparing, we get
$\tan\theta = \sqrt{3} \Rightarrow \theta = 60^\circ$ from horizontal.
The angle of projection with vertical is
$\alpha = 90^\circ - \theta \Rightarrow \alpha = 30^\circ$

**(2)** **Answer :** (4)
**Solution:**
Put, y = 0 $\Rightarrow 2x = 8x^2 \Rightarrow x = 0.25$ m

**(3)** **Answer :** (1)
**Solution:**
$a = \sqrt{3^2 + 4^2} = 5\ \text{m/s}^2$
$S = \frac{1}{2}(5)(2)^2 = 10\,\text{m}$

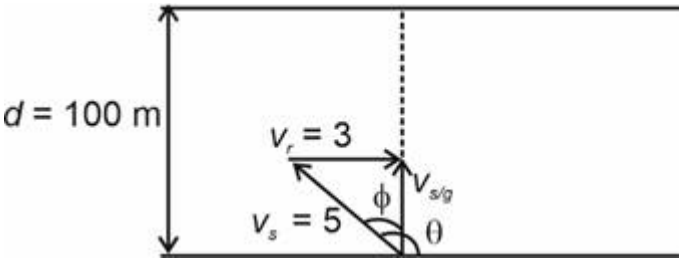
**(4)** **Answer :** (2)
**Solution:**
$\frac{H_1}{H_2} = \frac{\cos^2\theta_1}{\cos^2\theta_2} = \frac{\cos^2 30^\circ}{\cos^2 60^\circ} = 3 : 1$

**(5)** **Answer :** (1)
**Solution:**
At highest point, $\vec{v} = \left(16\hat{i}\right)$ m/s
$\therefore v = 16$ m/s

**(6)** **Answer :** (1)
**Solution:**
$T = \frac{2u_y}{g} = \frac{2\times 8}{10} = \frac{8}{5}\text{s}$

**(7)** **Answer :** (1)
**Solution:**
When it reaches the ground, the vertical component of velocity gets reversed that is along negative Y–axis.

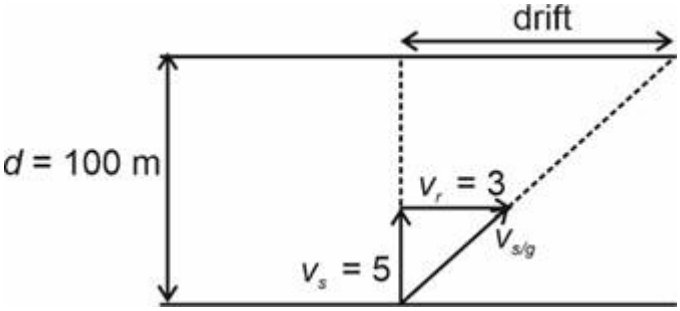
**(8)** **Answer :** (3)
**Solution:**
For zero drift :




$5\sin\phi = 3 \Rightarrow \phi = 37^\circ$
$\therefore \theta = 90^\circ + 37^\circ = 127^\circ$
Time taken, $t = \frac{d}{v_s\cos\phi} = \frac{100}{4} = 25$ s
For Minimum time :
$\theta = 90^\circ$

Time to cross the river, $t = \frac{100}{5} = 20$ s

Drift = $v_X \times t = 3 \times 20 = 60$ m




**(9)** **Answer :** (1)

**Hint:**

$\vec{v} = \frac{d\vec{r}}{dt}$, $\tan\theta = \frac{v_y}{v_x}$

**Solution:**

$\vec{r} = 8t\,\hat{i} + t^2\hat{j} + 3\hat{k}$

$\vec{v} = \frac{d\vec{r}}{dt} = 8\hat{i} + 2t\hat{j} + 0\hat{k}$

$\vec{v}\left(t = 2\right) = \left(8\hat{i} + 4\hat{j}\right)$ m/s

$\tan\theta = \frac{v_y}{v_x} = \frac{4}{8} = \frac{1}{2}$

**(10)** **Answer :** (4)

**Hint:**

Use $\vec{S} = \vec{u}t + \frac{1}{2}\vec{a}t^2$

**Solution:**

Since initial position vector is zero, therefore

$\vec{r} = \vec{u}t + \frac{1}{2}\vec{a}t^2 \;\Rightarrow\; \vec{r} = 0 + \frac{1}{2} \times \left(7\hat{i} + 3\hat{j}\right) \times 4$

$\vec{r} = \left(14\hat{i} + 6\hat{j}\right)$m

**(11)** **Answer :** (1)

**Hint:**

Horizontal velocity of the particle will remain same

**Solution:**

Horizontal distance = horizontal velocity × time = 20 × 2 = 40 m

**(12)** **Answer :** (1)

**Hint:**

Use, $\tan\theta = \frac{u_y}{u_x}$

**Solution:**

$u_X$ = 3 m/s

$u_Y$ = 4 m/s

$\tan\theta = \frac{4}{3} \;\Rightarrow\; \theta = 53^\circ$

**(13)** **Answer :** (4)

**Hint:**

Equation of projectile is $y = x\tan\theta\left(1 - \frac{x}{R}\right)$

**Solution:**

$R = \frac{u^2 \sin 90}{10} = 40$ m

$y = x\tan\left(45^\circ\right)\left(1 - \frac{x}{40}\right) = x - \frac{x^2}{40}$

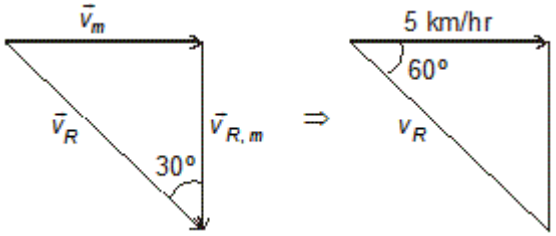
**(14)** **Answer :** (4)

**Solution:**

A particle moving with uniform speed in a circular path maintains varying velocity and varying acceleration. It is because direction of both velocity as well as acceleration will change continuously.

**(15)** **Answer :** (2)
**Solution:**
The velocity triangle will be

$\vec{v}_{R,m} = \vec{v}_R - \vec{v}_m$




$v_R \cos 60° = 5$ km/hr

$\Rightarrow v_R = \frac{5}{\frac{1}{2}} = 10$ km/hr

**(16)** **Answer :** (3)
**Solution:**
At point of maximum height, only horizontal velocity exists and acceleration is vertically downwards.

**(17)** **Answer :** (3)
**Hint:**
$\vec{P} + \vec{Q} = \hat{i}$
**Solution:**
$\vec{P} + \vec{Q} = \hat{i}$
$\vec{Q} = \hat{i} - (\hat{i} + 2\hat{j} - 3\hat{k})$
$= \hat{i} - \hat{i} - 2\hat{j} + 3\hat{k}$
$\vec{Q} = -2\hat{j} + 3\hat{k}$
$\left|\vec{Q}\right| = \sqrt{4+9}$
= $\sqrt{13}$ units

**(18)** **Answer :** (3)
**Solution:**
$R = \frac{u^2 \sin 2\theta}{g}$
$\frac{R_1}{R_2} = \frac{\sin 60}{\sin 120}$ = 1 : 1

**(19)** **Answer :** (4)
**Solution:**
- In uniform circular motion, speed of object remains constant while acceleration changes continuously.
- Speed is a scalar quantity while velocity and acceleration are both vector quantities.

**(20)** **Answer :** (3)
**Solution:**
*u*cosθ = 1 m/s and *u*sinθ = 1 m/s
$y = \tan\theta\, x - \frac{g}{2u^2 \cos^2\theta} x^2$
$y = x - \frac{10}{2} x^2 = x - 5x^2$

**(21)** **Answer :** (2)
**Solution:**
$20\sqrt{2} \cos 60^\circ = v \cos 45^\circ$
$20\sqrt{2} \times \frac{1}{2} = \frac{v}{\sqrt{2}}$
$v$ = 20 m s$^{-1}$

**(22)** **Answer :** (4)

**Solution:**

$\tan 90^\circ = \frac{Q\sin\theta}{P+Q\cos\theta}$ or $P + Q\cos\theta = 0$

$\Rightarrow \cos\theta = \frac{-P}{Q}$

$R = \frac{Q}{2} = \sqrt{P^2+Q^2+2PQ\cos\theta}$

$\frac{Q^2}{4} = P^2+Q^2+2PQ\times\frac{-P}{Q}$

On solving

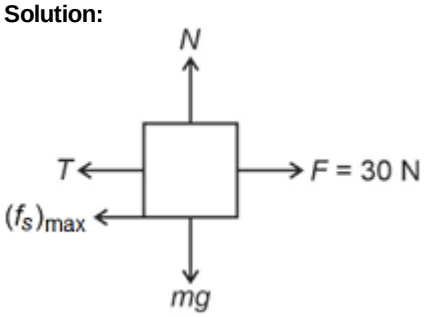
$\frac{P}{Q} = \frac{\sqrt{3}}{2}$

$\cos\theta = \frac{-\sqrt{3}}{2} = \cos 150^\circ$

$\theta = 150^\circ$

**(23) Answer :** (1)

**Solution:**




$N = 2 \times 10 = 20$ N

$(f_S)_{max} = \mu \times N = 0.5 \times 20 = 10$ N

$T + (f_S)_{max} = F \Rightarrow T + 10 = 30 \Rightarrow T = 20$ N

**(24) Answer :** (1)

**Solution:**

Applying conservation of linear momentum

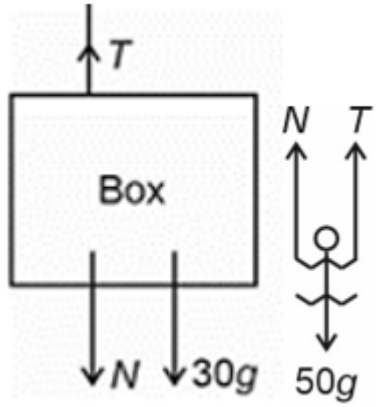
$MV = mv$

$100V = 0.2 \times 80$

$V = \frac{16}{100}$ m/s $= 16$ cm/s

**(25) Answer :** (1)

**Solution:**




$T = N + 30g$

$N + T = 50g$

On solving $T = 400$ N

**(26) Answer :** (2)

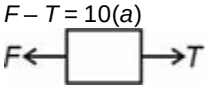
**Hint:**

Acceleration of system $a = \frac{F}{m_1+m_2+m_3}$

**Solution:**

Here, $a = \frac{40}{20} = 2$ m/s$^2$

From FBD of 10 kg block
$F - T = 10(a)$



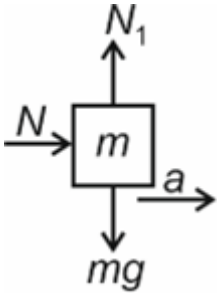

$40 - T = 20$
$\therefore \quad T = 20$ N

**(27) Answer :** (1)
**Solution:**
$F = \frac{mv^2}{r}, \ P = mv$
Hence, $F = \frac{p^2}{mr}$

**(28) Answer :** (1)
**Solution:**
$v = \sqrt{\mu_s Rg} = \sqrt{0.5 \times 13 \times 10}$
$= \sqrt{65} = 8.06 \approx 8 \ \mathrm{m/s}$

**(29) Answer :** (2)
**Solution:**
As speed of raindrop is constant, its acceleration is zero.
$\therefore$ Net force is zero
$F$-mg = ma
$\Rightarrow F = 3 \times 10^5$ N
The internal action and reaction forces between different parts of a body do, add upto zero.

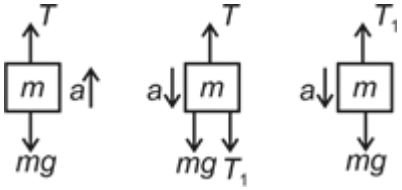
**(30) Answer :** (1)
**Solution:**




$a = \frac{F_{net}}{M+m} = \frac{100}{20+5} = 4 \ \mathrm{m/s^2}$
$N = ma$
$N = 5 \times 4 = 20 \ \mathrm{N}$

**(31) Answer :** (1)
**Solution:**
We break projectile motion into motions along $x$ and $y$ axes because motions along two mutually perpendicular directions are independent of each other.

**(32) Answer :** (4)
**Solution:**




$T - mg = ma$…(i)
$mg + T_1 - T = \mathrm{ma}$…(ii)
$mg - T_1 = ma$…(iii)
from (i), (ii), and (iii),
$T_1 = \frac{2mg}{3}$

**(33) Answer :** (2)
**Solution:**

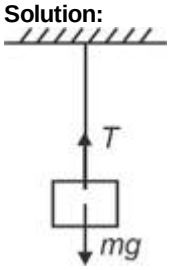
$a = \frac{(60-15-10-15)}{2+3}$ = 4 m/s$^2$
$60 - T - 15 = 3 \times 4$
$\therefore T = 33$ N

**(34) Answer :** (2)
**Solution:**
Impulse = $\Delta\vec{p}$ (change in momentum)
Velocity of body just before t = 2 s is $v_i = \frac{10}{2} = 5$ m/s
Velocity just after the $t = 2$ s is $v_f = 0$

$\Delta\vec{p} = m\left(\vec{v}_f - \vec{v}_i\right)$
$= 1(0-5)$
$= -5$ kg m s$^{-1}$

**(35) Answer :** (3)
**Solution:**
(a) When a bus starts moving, the lower part of person's body starts moving while upper part remains at rest so person falls backwards.
(b) A frame moving with constant velocity is also a inertial frame.

**(36) Answer :** (2)
**Solution:**




Here tension is acting away from the object, therefore it is pulling force.
$\sum\vec{F} = 0$
$T - mg = 0$
$T = mg$
Static friction is a self adjusting force.

**(37) Answer :** (2)
**Solution:**
$\mu \times 10 = mg$
$0.25 \times 10 = mg$
Weight = 2.5 N

**(38) Answer :** (3)
**Solution:**
$F_{avg} = \frac{\Delta P}{\Delta t}$
$= \frac{2mv\sin 30^\circ}{\Delta t} = \frac{10}{0.05} = 200$ N

**(39) Answer :** (2)
**Solution:**
$\tan\alpha = \mu$
$\Rightarrow \tan\alpha = \sqrt{3}$
$\Rightarrow \alpha = 60°$

**(40) Answer :** (2)
**Hint:**
$W_{app} = m(g+a)$
**Solution:**
$a = 2$ m s$^{-2}$, $g = 10$ m s$^{-2}$
$W_{app} = 50(10+2)$
= 600 N

**(41) Answer :** (4)
**Hint:**
$a = \frac{F}{m}$
**Solution:**
$F$ = 10 N, $m$ = 1 kg
$v = u + at = 0 + \left[\frac{10}{1}\right] 5 = 50 \text{ m s}^{-1}$

**(42) Answer :** (2)
**Hint:**
Tension in the rope should not exceed its breaking strength
**Solution:**
$T - mg = ma$
$T = m(g + a)$
$250 = 20(10 + a)$
$a = 2.5 \text{ m/s}^2$

**(43) Answer :** (4)
**Solution:**
$\vec{a} = 0$
Thus, for each mass $\vec{F}_{\text{net}} = 0$

**(44) Answer :** (4)
**Solution:**
$F$ = 1 N and $f_{max} = \mu N = 0.2 \times 6 \times 10 = 12$ N
$F < \mu N \Rightarrow a = 0$

**(45) Answer :** (1)
**Solution:**
$F = \left(\frac{\Delta p}{\Delta t}\right) = \frac{n(mu-0)}{(1)} = mnu$

## Pheonix

## CHEMISTRY

**(46) Answer :** (3)
**Hint:**
For multi-electronic species, higher is the value of (n + l) higher is the energy of orbital.
**Solution:**
$5p \rightarrow$ n + l = 6
$5s \rightarrow$ n + l = 5
$4p \rightarrow$ n + l = 5
$3d \rightarrow$ n + l = 5
If (n + l) value is same, higher is value of n higher is energy
So correct order
$5p > 5s > 4p > 3d$

**(47) Answer :** (1)
**Hint:**
E is inversely proportional to λ
**Solution:**
$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$
$\frac{25}{100} = \frac{\lambda_2}{\lambda_1}$
$\lambda_1 = 4\lambda_2$

**(48) Answer :** (3)
**Hint:**
For a given value of n,
l = 0, 1, 2... (n – 1)
**Solution:**
for n = 5
l can have value = 0, 1, 2, 3, 4

Hence for n = 5, l ≠ 5

**(49) Answer :** (2)
**Hint:**
Number of angular nodes = $l$
Number of radial nodes = n – $l$ – 1
**Solution:**
For $4d_{x^2-y^2}$
subshell, n = 4, $l$ = 2
Number of radial nodes = 4 – 2 – 1 = 1
Number of angular nodes = $l$ = 2

**(50) Answer :** (4)
**Hint:**
$\lambda = \frac{h}{mv}$
**Solution:**
$\lambda = \frac{h}{mv} = \frac{6.6\times10^{-34}}{0.66\times10^{3}} = 1\times10^{-36}m$

**(51) Answer :** (1)
**Hint:**

$r_n = 52.9 \times \frac{n^2}{z}$pm and $n\lambda = 2\pi r_n$

**Solution:**

$r_n = 52.9 \times \frac{16}{4} = 211.6$ pm

$\lambda = \frac{2\pi r_n}{n}$

$= \frac{2\pi \times 211.6}{4}$

$= 105.8\pi$ pm

**(52) Answer :** (2)
**Hint:**
Energy of photon = hν
**Solution:**
Power of bulb = 100 $Js^{-1}$
Energy of one photon = $E = \frac{hc}{\lambda}$
$= \frac{6.626\times10^{-34}\times3\times10^{8}}{6.626\times10^{-12}} = \frac{10^{-34}\times3\times10^{8}}{10^{-9}}$
$= 3\times10^{-17}$ J
Number of photons emitted = $\frac{100}{3\times10^{-17}}$
$= 33.33\times10^{17}$
$= 3.33\times10^{18}s^{-1}$

**(53) Answer :** (2)
**Hint:**
Electron is more tightly bound to the nucleus in smallest allowed orbit.
**Solution:**
electron has more negative energy in n = 1 than n = 5.
∴ electron is tightly bound to nucleus in n = 1.
For 'l'subshell, maximum number of electrons are $4l+2$

**(54) Answer :** (1)
**Solution:**
Because $(E_2 - E_1) > (E_3 - E_2) > (E_4 - E_3) > (E_5 - E_4) > (E_6 - E_5)$
As the difference is of one energy levels
∴ $(E_6 - E_5)$ have less energy
{Alternatively value of ΔE [difference between two successive energy level decreases] as the distance from the nucleus increases.}

**(55) Answer :** (4)
**Solution:**
$\mathrm{K.E.} = \mathrm{h}(\nu - \nu_0)$
$= 6.6 \times 10^{-34} (1.1 \times 10^{12} - 1 \times 10^{11})$
$= 6.6 \times 10^{-34} \times 1 \times 10^{12}$
$= 6.6 \times 10^{-22}$ J

**(56) Answer :** (2)
**Solution:**
Option (1) violates Aufbau principle as without filling 2s completely, electrons are filled in 2p
Option (2) violates Pauli's exclusion principle as an atomic orbital can accommodate 2 electrons with opposite spins and violates Hund's rule

**(57) Answer :** (3)
**Solution:**
Cathode rays travel from negative electrode (cathode) to positive electrode (anode)

**(58) Answer :** (4)
**Hint:**
Ground state electronic configuration of Mn and Cu are
Mn = [Ar] $4s^2 3d^5$ ; $Mn^{2+}$ = [Ar] $3d^5$
Cu = [Ar] $4s^1$ $3d^{10}$ ; $Cu^+$ = [Ar] $3d^{10}$
**Solution:**
Number of 'd' electrons in $Mn^{2+}$ = 5
Number of 'd' electrons in $Cu^+$ = 10
Ratio = 5 : 10
= 1 : 2

**(59) Answer :** (1)
**Solution:**
P + n = 56 ...(1)
Number of electron = P – 3
Number of neutron = (P – 3) + (P – 3) 0.304
P + P – 3 + (P – 3) 0.304 = 56
2.304 P = 59.912
$\mathrm{P} = \frac{59.912}{2.304} = 26.0034$

**(60) Answer :** (3)
**Hint:**
Phenomena which are associated with the characteristics of waves can be explained by wave nature of electromagnetic radiation
**Solution:**
• Diffraction and interference can be explained by the wave nature of electromagnetic radiation.
• Black-body radiation and photoelectric effect can be explained by the particle nature of electromagnetic radiation.

**(61) Answer :** (3)
**Hint:**
Bohr's theory could not explain ability of atoms to form molecules by chemical bonds
**Solution:**
Bohr's theory was unable to explain the splitting of spectral lines in the presence of magnetic field or an electric field.

**(62) Answer :** (4)
**Solution:**
$\frac{1}{\lambda} = \mathrm{R_H}\left[\frac{1}{\mathrm{n_1^2}} - \frac{1}{\mathrm{n_2^2}}\right] \mathrm{cm}^{-1}$
For longest wavelength, $n_2$ =2, $n_1$ = 1
$\bar{\mathrm{v}} = \mathrm{R_H}\left[\frac{1}{1^2} - \frac{1}{2^2}\right]$
$\bar{\mathrm{v}} = \mathrm{R_H}\left[\frac{4-1}{4}\right]$
$\bar{\mathrm{v}} = \frac{3}{4}\mathrm{R_H}$

**(63) Answer :** (3)
**Solution:**

Orbital angular momentum = $\sqrt{l(l+1)}\,\hbar$

$= \sqrt{2 \times 3}\,\hbar = \sqrt{6}\,\hbar$

**(64)** **Answer :** (3)
**Hint:**
IUPAC official name of element with atomic number 101 is Mendelevium.
**Solution:**

| Column I | Column II |
|---|---|
| 101 | Mendelevium |
| 103 | Lawrencium |
| 104 | Rutherfordium |
| 108 | Hassium |

**(65)** **Answer :** (3)
**Hint:**
Amphoteric oxides behaves as acidic compound with bases and as basic compound with acid.
**Solution:**
$Na_2O$ = Basic
$Cl_2O_7$ = Acidic
$N_2O$ = Neutral
$Al_2O_3$ = Amphoteric

**(66)** **Answer :** (4)
**Hint:**
Boron does not have *d*-orbital.
**Solution:**
For alkali metals, as the shell size for valence electron increases, the ionisation energy decreases.

**(67)** **Answer :** (3)
**Hint:**
Cerium (Ce) is *f*-block element
**Solution:**
• *s* and *p* block elements are called representative elements. Bismuth (Bi) and rubidium (Rb) are *p* and *s* block elements respectively.
• Ge and Sb are semi-metals or metalloids.
• Ti is *d* block element.

**(68)** **Answer :** (1)
**Hint:**
Electron gain enthalpy generally becomes less negative on moving down the group.
**Solution:**
Due to smaller size of 2*p* orbitals, the upcoming electron experiences repulsion with valence electrons and hence O has least negative electron gain enthalpy among group 16 elements.

**(69)** **Answer :** (2)
**Solution:**
After removal of an electron from $1s^2\ 2s^2\ 2p^1$ it goes to inert gas configuration, hence it will have least first ionisation enthalpy.

**(70)** **Answer :** (2)
**Solution:**
Ionisation enthalpy : $Na \rightarrow Na^+ + e^-$
E = 5.1 eV
Electron gain enthalpy : $Na^+ + e^- \rightarrow Na$
E = –5.1 eV

**(71)** **Answer :** (3)
**Solution:**
Metallic character and reactivity increases down the group and decreases on moving from left to right across the period.

**(72)** **Answer :** (2)
**Hint:**
Element below aluminium in periodic table is called Ekaaluminium.

**Solution:**
• Potassium is more electropositive than sodium.
• Electron gain enthalpy of inert gases is positive.

**(73)** **Answer :** (2)
**Solution:**
For atomic number (Z) = 113,
Group = 13
Period = 7
If belongs to Boron family.

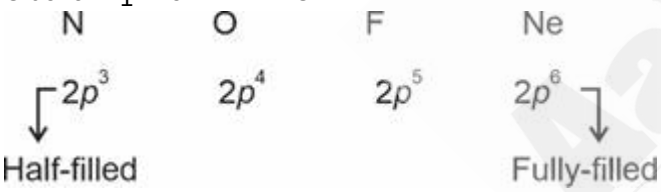
**(74)** **Answer :** (1)
**Hint:**
Neptunium comes after uranium in periodic table
**Solution:**
Samarium is a lanthanoid element

**(75)** **Answer :** (2)
**Solution:**
Radius of anionic species are always greater than their parent atomic radius.
In $Cl_2$ molecule the covalent radius is less than the atomic radius.

**(76)** **Answer :** (4)
**Solution:**

| Atomic number | Block |
|---|---|
| 37(Rb) | s-block |
| 78(Pt) | d-block |
| 52(Te) | p-block |
| 65(Tb) | f-block |

**(77)** **Answer :** (3)
**Hint:**
High ionisation energy is required to remove electron from half-filled and fully filled configuration.
**Solution:**
Order of $IE_1$ : Ne > F > N > O




**(78)** **Answer :** (4)
**Solution:**
Down the group electron affinity decreases due to increase in size. So, electron affinity of S > Se and Li > Na. But in case of F and Cl, Cl > F due to small size of F atom.

**(79)** **Answer :** (3)
**Solution:**
IE is endothermic
Electron affinity = Sucessive EA is endothermic and also for elements with stable configuration.

**(80)** **Answer :** (4)
**Solution:**
Electronegativity values of nitrogen and chlorine both are 3.0 on Pauling scale.

**(81)** **Answer :** (3)
**Solution:**
Cu, Ag and Au are coinage metals. These do not belong to Dobereiner's Triads.

**(82)** **Answer :** (2)
**Solution:**
The electron gain enthalpy values are
He = 48 kJ $mol^{-1}$
Ne = 116 kJ $mol^{-1}$

Ar = 96 kJ $mol^{-1}$

Kr = 96 kJ $mol^{-1}$

**(83)** **Answer :** (1)
**Solution:**
I.P. suggest $13^{th}$ group.

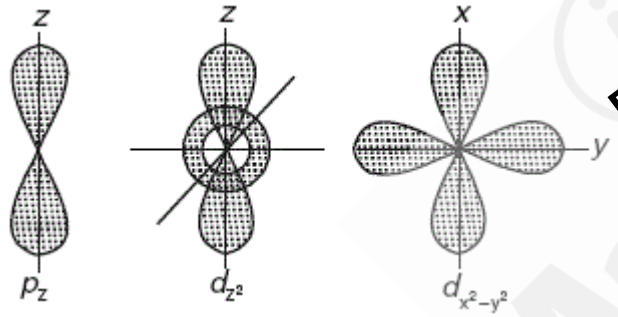
**(84)** **Answer :** (2)
**Solution:**
- The given element is chlorine.
- Atomic number of element below chlorine in periodic table.

17 + 18 = 35

**(85)** **Answer :** (1)
**Hint:**
Kinetic energy of electrons increases with the increase of frequency of light.
**Solution:**
The number of electrons ejected is proportional to the intensity of light.

**(86)** **Answer :** (3)
**Solution:**
Correct order of wavelength is
Radio waves > IR > UV > X-rays

**(87)** **Answer :** (1)
**Hint:**
$d_{xy}$, $d_{yz}$ and $d_{zx}$ are non-axial orbitals.
**Solution:**
$p_Z$, $d_{x^2-y^2}$ and $d_{Z^2}$ orbitals contain lobes along the axes hence electron density is distributed along the axes.




**(88)** **Answer :** (1)
**Hint:**
$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$
**Solution:**
$\Delta p = 2\Delta x$

$\therefore \frac{(\Delta p)^2}{2} = \frac{h}{4\pi}$

$\Delta p = \sqrt{\frac{h}{2\pi}}$

$\Delta v = \frac{1}{m}\sqrt{\frac{h}{2\pi}}$

**(89)** **Answer :** (3)
**Hint:**
For H – atom energy of orbital depends only on value of n.

**(90)** **Answer :** (1)
**Hint:**
Number of proton is equal to atomic number of element
**Solution:**
number of proton = Z = 104
Number of electron = 104
Number of neutron = A – Z
= 261 – 104 = 157

**BOTANY**

**(91) Answer :** (1)
**Solution:**
The best stage to study the different shapes of the chromosomes is anaphase.

**(92) Answer :** (2)
**Solution:**
First letter of the second word of biological name is small, as it represents the specific epithet.

**(93) Answer :** (4)
**Solution:**
Introduction of variation occurs in meiosis not mitosis.

**(94) Answer :** (1)
**Solution:**
DNA replication does not occur in $G_1$-phase, M-phase and interkinesis.

**(95) Answer :** (3)
**Solution:**
Human beings belongs to the species s*apiens* which is grouped in the genus *Homo*.

**(96) Answer :** (2)
**Hint:**
The non-dividing cell enters the quiescent stage or $G_0$ stage of the cell cycle.
**Solution:**
Cells in $G_0$ stage remain metabolically active but no longer proliferate unless called on to do so. Therefore, these cells can return the cell cycle depending on the requirement of the organism.

**(97) Answer :** (4)
**Hint:**
Mitotic cell division takes place in cells of meristem in plant.
**Solution:**
Number of generation (n) of mitosis for producing 'x' cells is $x = 2^n$
$\Rightarrow 256 = 2^n$
$\Rightarrow n = 8$

**(98) Answer :** (3)
**Solution:**
Homologous chromosomes separate from each other during the anaphase I of meiosis I.

**(99) Answer :** (2)
**Solution:**
$G_0$ is known as quiescent stage.

**(100) Answer :** (3)
**Hint:**
Synaptonemal complex is formed in zygotene stage.
**Solution:**
Diplotene – Dissolution of synaptonemal complex
Pachytene – Crossing over
Leptotene – First stage of prophase I

**(101) Answer :** (1)
**Solution:**
Prophase is short and without substages. Prophase-I lacks splitting of centromere. Prophase I have crossing over phenomenon.

**(102) Answer :** (2)
**Solution:**
The two asters together with spindle fibres forms mitotic apparatus.

**(103) Answer :** (2)
**Hint:**

M-phase is the phase of actual cell division.
**Solution:**
Synthesis of DNA occurs in S-phase which is a part of interphase.
Assembly of mitotic apparatus, dissolution of nuclear envelope and reformation of nucleolus are features of M-phase.

**(104) Answer :** (2)
**Solution:**
In $G_1$ phase, cell is metabolically active and grows continuously without DNA replication.

**(105) Answer :** (2)
**Solution:**
Cytokinesis occurs in plants by cell plate formation in animals by furrow formation.

**(106) Answer :** (1)
**Solution:**
Most active stage of cell cycle is interphase.
Interphase includes $G_1$, S and $G_2$-phases while M-phase is the phase of actual division in cell cycle.

**(107) Answer :** (4)
**Solution:**
Wheat belongs to the class Monocotyledonae.
Both wheat and mango belong to the same division, *i.e.,* Angiospermae.

**(108) Answer :** (4)
**Hint:**
Meiosis involves reductional division and equational division.
**Solution:**
Meiosis involves two sequential cycles of nuclear and cell division called meiosis I and meiosis II but only a single cycle of DNA replication.

**(109) Answer :** (1)
**Hint:**
Muscidae and Poaceae are families.
Mammalia and Insecta are classes.
**Solution:**
Poales, Diptera, Sapindales, and Primata are orders.

**(110) Answer :** (4)
**Solution:**
Prophase (d) → Metaphase (b) → Anaphase (a) → Telophase (c)

**(111) Answer :** (3)
**Solution:**
Monkey, gorilla and gibbon are placed under the order, Primata.

**(112) Answer :** (1)
**Solution:**
Telophase is end phase of karyokinesis

**(113) Answer :** (3)
**Solution:**
Oocytes of some vertebrates get arrested at diplotene stage for months or years. It is known as dictyotene stage.

**(114) Answer :** (2)
**Solution:**
In metaphase I, bivalents arrange themselves at the equitorial plate, in contrast to metaphase II where univalents arrange themselves at the equitorial plate.

**(115) Answer :** (2)
**Hint:**
Prophase is marked by the initiation of condensation of chromosomal material.
**Solution:**
During metaphase spindle fibres attach to kinetochores of chromosomes.
Condensation of chromosomal material and movement of centrosome towards opposite pole occur during prophase.

**(116) Answer :** (2)
**Solution:**
The cells formed by mitosis are identical to each other as well as to the parent cell.
The daughter cells formed by mitosis have same number of chromosomes as that in the parent cell. That is why, this division is called equational division.

**(117) Answer :** (3)
**Solution:**
Semi autonomous cell organelles are mitochondria and chloroplast that duplicate in $G_2$ phase.

**(118) Answer :** (1)
**Hint:**
The growth of multicellular organisms is due to mitosis.
**Solution:**
Cell growth results in disturbing the ratio between the nucleus and the cytoplasm. It therefore becomes essential for the cell to divide to restore the nucleo-cytoplasmic ratio.

**(119) Answer :** (2)
**Hint:**
The phenomenon of bringing the chromosomes on the equator of spindle is called congression.
**Solution:**
Congression is observed in metaphase.

**(120) Answer :** (4)
**Solution:**
The word systematics is derived from the Latin word 'Systema'.

**(121) Answer :** (1)
**Solution:**
In unicellular organisms, reproduction is synonymous with growth.

**(122) Answer :** (3)
**Solution:**
Kingdom, phylum or division, class, order, family, genus, species are seven obligate categories.

**(123) Answer :** (2)
**Solution:**
Tetrad consists of a pair of homologous chromosomes or four chromatids. It is clearly visible in the pachytene stage.

**(124) Answer :** (3)
**Solution:**
Cell cycle is divided into two basics phases *i.e.*, interphase and M phase.

**(125) Answer :** (3)
**Solution:**
Bivalent formation is an exclusive event of meiosis.

**(126) Answer :** (2)
**Solution:**
In some organisms karyokinesis is not followed by cytokinesis as a result of which multinucliate condition arises leading to the formation of syncitium.

**(127) Answer :** (3)
**Hint:**
Interkinesis is a metabolic stage between telophase I and prophase II.
**Solution:**
During interkinesis, no DNA replication occurs. In male honey bees, haploid cells divide by mitosis.

**(128) Answer :** (2)
**Solution:**
ICBN stands for International Code for Botanical Nomenclature.

**(129) Answer :** (4)
**Solution:**
Self consciousness is seen in humans only.
Both self consciousness and growth are characteristic features of living organisms. In unicellular organisms growth and reproduction are synonymous.

**(130) Answer :** (2)
**Solution:**
Dicotyledonae is a class.
Mammalia is a class.
Diptera is an order.

**(131) Answer :** (4)
**Solution:**

Systematics is same as of taxonomy except phylogeny. Systematics along with classification, nomenclature and identification includes phylogeny also.

**(132) Answer :** (4)
**Solution:**
Properties of tissues arise as a result of interactions among the constituent cells.

**(133) Answer :** (4)
**Solution:**
All organisms show metabolism.

**(134) Answer :** (2)
**Solution:**
– *Mangifera* and *Triticum* – Genus
– Anacardiaceae and Poaceae – Family
– Primata and Diptera – Order
– Mammalia and Insecta – Class
– Higher the category greater is the difficulty of determining the relationship to the other taxa at the same level.

**(135) Answer :** (2)
**Hint:**
Different kinds of organisms are referred to as biodiversity of the earth.
**Solution:**
Biodiversity is the number and various kinds of organisms found on earth. It stands for the variability found among living organisms inhabiting this world.

**ZOOLOGY**

**(136) Answer :** (1)
**Hint:**
α-carbon is directly attached with four different groups.
**Solution:**
The four different groups found attached to the α-carbon in amino acids are amino group, carboxyl group, hydrogen and a variable R group which is H in glycine, methyl in alanine and different in other amino acids.

**(137) Answer :** (4)
**Solution:**
Tyrosine, tryptophan and phenylalanine are aromatic amino acids.

**(138) Answer :** (2)
**Solution:**
The first amino acid is also called the N-terminal amino acid. The last amino acid is called the C-terminal amino acid.

**(139) Answer :** (3)
**Solution:**
Amino acids have ionizable nature due to $-NH_2$ and $-COOH$ groups. Hence, in solutions of different pH, the structure of amino acids changes.

**(140) Answer :** (4)
**Solution:**
Cellulose is a polysaccharide of glucose. Antibodies, insulin and receptors, all are polymers of amino acids.

**(141) Answer :** (1)
**Solution:**
Glycine is unique in being optically inactive as it has hydrogen as the R group. It is the simplest amino acid.

**(142) Answer :** (3)
**Hint:**
Glycine
**Solution:**
Glycerol is chemically trihydroxy propane
Palmitic acid ($CH_3–(CH_2)_{14}–COOH$) is a saturated fatty acid that does not possess double bond.
Glycine is the simplest amino acid.
Ribose is the pentose sugar of RNA.

**(143) Answer :** (2)

**Solution:**
Based on number of amino and carboxyl groups, there are acidic (*e.g.*, aspartic acid, glutamic acid), basic (lysine) and neutral (valine) amino acids. Similarly, there are aromatic amino acids (tyrosine, phenylalanine, tryptophan).

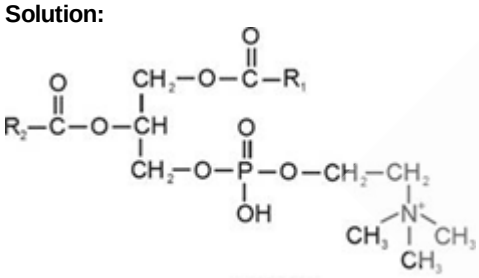
**(144) Answer :** (3)
**Solution:**
Insulin is a hormone (protein) which acts as an intercellular messenger. Proteins are heteropolymers.
Inulin is a storage homopolysaccharide. It is made up of fructose and is found in plants. In proteins, the left end is the N-terminal whereas the right end is the C-terminal.

**(145) Answer :** (1)
**Solution:**
Adult human haemoglobin consists of 4 subunits. Two of these are identical to each other. Hence, two subunits of α type and two subunits of β type together constitute the human haemoglobin (Hb). They exhibit the quaternary structure of protein.

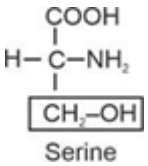
**(146) Answer :** (1)
**Solution:**
Option (1) is the correct answer because statements (c), (d) and (e) are correct. Oils have lower melting point and hence remain as oil in winters. Lipids are generally insoluble in water but soluble in some organic solvents like chloroform or benzene.
Option (2), (3) and (4) are incorrect because statements (a) and (b) are incorrect. Lecithin is a type of phospholipid found in plasma membrane. Saturated fatty acids are without double bond (C = C).

**(147) Answer :** (4)
**Solution:**
Palmitic acid has 16 carbons including the carboxyl carbon. Arachidonic acid has 20 carbon atoms including the carboxyl carbon.
Cytidylic acid is a nucleotide. Glutamic acid is an amino acid.

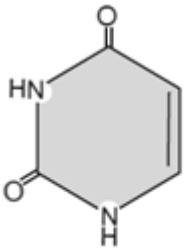
**(148) Answer :** (3)
**Hint:**
Equal to the number of eyes in humans.
**Solution:**



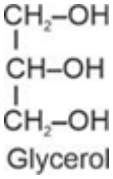
Lecithin



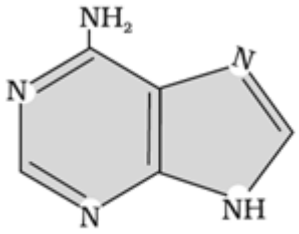
Serine



Uracil (Pyrimidine)



Glycerol



Adenine (Purine)

**(149) Answer :** (4)
**Solution:**
Triglyceride $\xrightarrow{\text{Hydrolases}}$1 molecule of glycerol + 3 molecules of fatty acids
Enzymes are divided into 6 classes, each with 4-13 subclasses and named accordingly by a four digit number called enzyme commission or E.C. number, where the first digit represents the class of enzyme.
Hydrolases catalyse hydrolysis of ester, ether, peptide, glycosidic, C–C, C-halide or P–N bonds.
It belongs to the class III of enzymes.

**(150) Answer :** (4)
**Solution:**
Substituted purines → Adenine and guanine (They are double ring heterocyclic structures)
Substituted pyrimidines → Cytosine, uracil and thymine (They are single ring heterocyclic structures)
Uracil is present in RNA but not in DNA.

**(151) Answer :** (3)
**Solution:**
The nitrogen bases are projected more or less perpendicular to the sugar phosphate backbone but face inside.

**(152) Answer :** (1)
**Solution:**
According to Chargaff's rule:-
Total amount of purine is equal to the total amount of pyrimidine.
A = T = 30%
A + T = 60%
G + C = 40%
C = 20%
T = 30%
Hence, C + T = 50%

**(153) Answer :** (1)
**Solution:**
Adenosine is a nucleoside.
Adenylic acid and deoxyadenylic acid are nucleotides.

**(154) Answer :** (1)
**Solution:**
According to Chargaff's rule, A=T; G=C. Total number of nucleotides is 400.
Total number of H-bonds between A and T is 100 x2 = 200
Total number of H-bonds between G and C is 100 x3 = 300
Total = 500
Two hydrogen bonds in between A-T. Three hydrogen bonds in between C-G.

**(155) Answer :** (3)
**Solution:**
Increase in substrate concentration increases the velocity of the enzymatic reaction. The reaction ultimately reaches a maximum velocity ($V_{max}$) which is not exceeded by any further rise in concentration of the substrate. This is because, at this stage the enzyme molecules become fully saturated and no active site is left free to bind to the additional substrate molecules.

**(156) Answer :** (3)
**Hint:**
Prosthetic group
**Solution:**
There are three kinds of co-factors–prosthetic groups, co-enzymes and metal ions.
Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme. For example, in peroxidase and catalase, which catalyse the breakdown of hydrogen peroxide to water and

oxygen, haem is the prosthetic group and it is a part of active site of the enzyme. Zinc is a co-factor for the proteolytic enzyme carboxypeptidase.

**(157) Answer :** (4)
**Solution:**
Deviation in temperature and pH from optimum levels and presence of inhibitors affect the activity of an enzyme.
Enzyme lowers down the activation energy of a chemical reaction.

**(158) Answer :** (2)
**Solution:**
The essential chemical components of many coenzymes are vitamins *e.g*. coenzyme nicotinamide adenine dinucleotide (NAD) and NADP contain the vitamin niacin.

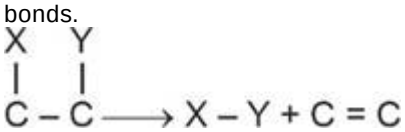
**(159) Answer :** (3)
**Hint:**
$E + S \rightleftharpoons ES \rightarrow EP \rightarrow E + P$
**Solution:**
The active site of the enzyme, in close proximity of the substrate, breaks the chemical bonds of the substrate and the new enzyme- product complex is formed.

**(160) Answer :** (4)
**Hint:**
Tertiary structure of proteins makes them biologically active.
**Solution:**
An enzyme like any protein has a primary, secondary and tertiary structure.
The tertiary structure of an enzyme has crevices or pockets into which the substrate fits. These crevices are called active sites which make the enzymes catalytically active.

**(161) Answer :** (2)
**Solution:**
The enzyme substrate complex is formed only for a short time and is a transient structure.
Products formed by an enzymatic reaction are stable but other intermediate states are unstable and transient.

**(162) Answer :** (4)
**Solution:**
In competitive inhibition, substrate and inhibitor compete for same catalytic site but only one can bind to it at a time.

**(163) Answer :** (4)
**Hint:**
Enzymes catalysing the transfer of a group.
**Solution:**
Enzymes catalysing the transfer of a group, G (other than hydrogen) between a pair of substrate S and S' are called transferases *e.g*.
S – G + S' $\rightarrow$ S + S' – G
**Oxidoreductases/dehydrogenases:** Enzymes which catalyse oxidoreduction between two substrates S and S' *e.g.*, S reduced + S' oxidised $\rightarrow$ S oxidised + S' reduced.
**Hydrolases:** Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C-C, C-halide or P-N bonds.
**Lyases:** Enzymes that catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.




**(164) Answer :** (3)
**Hint:**
Holoenzyme = Apoenzyme + Co-factor
**Solution:**
Co-enzymes are organic compounds but their association with the apoenzyme is only transient, usually occurring during the course of catalysis.
Essential components of many co-enzymes are vitamins, *e.g.* NAD and NADP contain vitamin niacin.

**(165) Answer :** (4)
**Solution:**
A non-proteinaceous enzyme is ribozyme.

**(166) Answer :** (2)
**Solution:**

The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the lung (pulmonary) cavity. Such an arrangement is essential for breathing, as we cannot directly alter the pulmonary volume.

**(167) Answer :** (2)
**Solution:**
During swallowing glottis can be covered by a thin elastic cartilaginous flap called epiglottis to prevent the entry of food into the larynx.

**(168) Answer :** (1)
**Hint:**
Birds perform pulmonary respiration
**Solution:**
*Aplysia* (Mollusc) – Feather- like gills
*Pheretima* (Annelid) – Moist cuticle
*Periplaneta* (Insect) – Tracheal tubes
*Aptenodytes* (Bird) – Lungs

**(169) Answer :** (3)
**Hint:**
Include the structures that form the major site of exchange of gases.
**Solution:**
The trachea, primary, secondary and tertiary bronchi, and initial bronchioles are supported by incomplete cartilaginous rings. Each terminal bronchiole gives rise to a number of very thin, irregular-walled and vascularised bag-like structures called alveoli.

**(170) Answer :** (3)
**Solution:**
We have two lungs which are covered by a double layered pleura, with pleural fluid between them. It reduces friction on the lung-surface. The outer pleural membrane is in close contact with the thoracic lining whereas the inner pleural membrane is in contact with the lung surface.



**(171) Answer :** (2)
**Hint:**
Diaphragm separates the thoracic cavity from the abdominal cavity.
**Solution:**
The lungs are situated in the thoracic chamber which is anatomically an air-tight chamber. The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by diaphragm.

**(172) Answer :** (2)
**Hint:**
FRC
**Solution:**
FRC (Functional Residual Capacity) – Volume of air that will remain in the lungs after a normal expiration.
FRC = ERV + RV
TLC (Total Lung Capacity) = RV + ERV + TV + IRV or VC + RV
VC (Vital Capacity) = ERV + TV + IRV

**(173) Answer :** (2)
**Solution:**
Mechanisms of breathing vary among different groups of animals depending mainly on their habitats and levels of organisation.

**(174) Answer :** (2)
**Solution:**
The nasal chamber opens into the pharynx, a portion of which is common passage for both food and air.

**(175) Answer :** (2)
**Hint:**
Cellular respiration is the last step.
**Solution:**
Respiration involves the following steps:
(i) Pulmonary ventilation
(ii) Diffusion of gases across alveolar membrane
(iii) Transport of gases by the blood
(iv) Diffusion of $O_2$ and $CO_2$ between blood and tissues
(v) Cellular respiration

**(176) Answer :** (1)

**Hint:**
Inspiration is an active process.
**Solution:**
Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure, *i.e.,* there is a negative pressure in the lungs with respect to atmospheric pressure. Inspiration is initiated by the contraction of diaphragm and external inter-costal muscles.
Diaphragm flattens during contraction and arches upwards during expiration.
• Volume of pulmonary cavity increases during normal inspiration by the contraction of diaphragm.
• The contraction of external inter-costal muscles lift ribs and sternum up and outward causing an increase in the volume of the thoracic cavity in the dorso-ventral axis.
• Mammals have negative pressure breathing.

**(177) Answer :** (2)
**Solution:**
On an average, a healthy human breathes 12-16 times/minute during resting state.

**(178) Answer :** (4)
**Solution:**
Spirometer can evaluate respiratory volumes to indicate lung function.

**(179) Answer :** (3)
**Solution:**
During normal inspiration and expiration in humans, diaphragm and external intercostal muscles are involved.
Abdominal and internal intercostal muscles are actively involved in forceful inspiration.

**(180) Answer :** (3)
**Solution:**
Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in antero-posterior axis. The contraction of external inter-costal muscles lifts up the ribs and sternum causing an increase in volume of the thoracic chamber in the dorso-ventral axis.