28/08/2024

Code-C_Phase-3

Aakash
Medical | IIT-JEE | Foundations

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**MM : 720** Fortnightly Test Series 2024-25_RM(P3)-Test-02C **Time : 200 Min.**

## PHYSICS

### SECTION-A

**1.** (2)
**2.** (3)
**3.** (2)
**4.** (1)
**5.** (1)
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**7.** (4)
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**34.** (1)
**35.** (2)



### SECTION-B

**36.** (1)
**37.** (2)
**38.** (1)
**39.** (3)
**40.** (2)
**41.** (4)
**42.** (1)
**43.** (4)
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**47.** (3)
**48.** (1)
**49.** (3)
**50.** (2)

## CHEMISTRY

### SECTION-A

**51.** (4)
**52.** (4)
**53.** (4)
**54.** (2)
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**56.** (4)
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**84.** (2)
**85.** (4)



### SECTION-B

**86.** (2)
**87.** (4)
**88.** (1)
**89.** (3)
**90.** (1)
**91.** (3)
**92.** (2)
**93.** (1)
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**99.** (2)
**100.** (2)

## BOTANY

### SECTION-A

**101.** (2)
**102.** (3)
**103.** (1)
**119.** (2)
**120.** (1)
**121.** (4)

**104.** (3)
**105.** (3)
**106.** (3)
**107.** (4)
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**134.** (4)
**135.** (3)

**SECTION-B**

**136.** (3)
**137.** (2)
**138.** (4)
**139.** (4)
**140.** (1)
**141.** (1)
**142.** (2)
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**146.** (2)
**147.** (2)
**148.** (4)
**149.** (3)
**150.** (2)



## ZOOLOGY

**SECTION-A**

**151.** (1)
**152.** (1)
**153.** (1)
**154.** (4)
**155.** (3)
**156.** (2)
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**185.** (2)

**SECTION-B**

**186.** (1)
**187.** (2)
**188.** (2)
**189.** (4)
**190.** (2)
**191.** (4)
**192.** (3)
**193.** (3)
**194.** (4)
**195.** (1)
**196.** (3)
**197.** (2)
**198.** (3)
**199.** (3)
**200.** (2)

## Hints and Solutions

## PHYSICS

### SECTION-A

**(1)** **Answer :** (2)
**Solution:**
$I = \Delta p = 5t^2 - 10t + 1$
$\Delta p = -4$ kg m $s^{-1}$

**(2)** **Answer :** (3)
**Solution:**
At point *B*, velocity is decreasing. Hence, acceleration produced due to force opposes the motion.

**(3)** **Answer :** (2)
**Solution:**
$v = \frac{dx}{dt} = 20 + 60t$
$a = \frac{dv}{dt} = 60$
$t = 1$, $f = 60$ N

**(4)** **Answer :** (1)
**Solution:**
Here $m = 0.2$ kg, $u = 0$
$\vec{F} = \left(0.3\hat{i} - 0.4\hat{j}\right)$
$v = ?$ $t = 6$ s
$a = \frac{F}{m} = \frac{0.3\hat{i} - 0.4\hat{j}}{0.2} = \left(\frac{3}{2}\hat{i} - 2\hat{j}\right)$
$v = u + at$
$v = 0 + \left(\frac{3}{2}\hat{i} - 2\hat{j}\right) \times 6$
$v = 9\hat{i} - 12\hat{j}$

**(5)** **Answer :** (1)
**Solution:**
$\frac{du}{u} \times 100 = -2\%$
$R = \frac{u^2 \sin 2\theta}{g}$
$\frac{dR}{R} \times 100 = 2\frac{du}{u} \times 100 = -4\%$

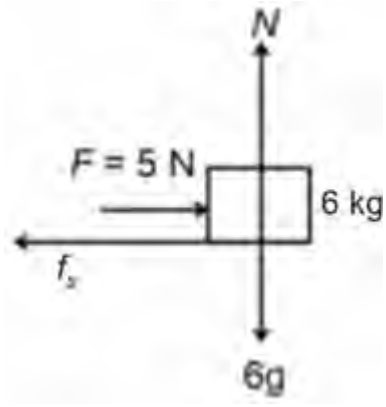
**(6)** **Answer :** (3)
**Solution:**
$\vec{F}_{avg} = m\frac{\Delta v}{\Delta t}$
$= \frac{1 \times 4\sqrt{2}}{2\sqrt{2}} = 2N$

**(7)** **Answer :** (4)
**Solution:**
$F = \frac{mv^2}{r}$, $P = mv$
$F = \frac{m^2v^2}{mr} = \frac{P^2}{mr}$

**(8)** **Answer :** (4)
**Solution:**
In equilibrium, $\Sigma F = 0$

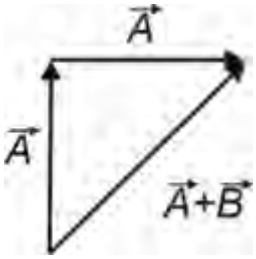
**(9)** **Answer :** (1)
**Solution:**
$N = F\cos\theta + mg$

**(10)** **Answer :** (1)
**Solution:**




$f_L = \mu_S \times N$
$= 0.2 \times 6g = 12$ N
$f_L > F$
$\therefore$ friction adjusts itself.
$\Rightarrow f_S = F = 5$ N

**(11) Answer :** (2)
**Solution:**




**(12) Answer :** (4)
**Solution:**
$\vec{v}_A = \left(\hat{i}+\hat{j}\right)$ m/s
$\vec{v}_B = \left(4\hat{i}-3\hat{j}\right)$ m/s
$\vec{v}_{B/A} = \vec{v}_B - \vec{v}_A$
$\vec{v}_{B/A} = \left(4\hat{i}-3\hat{j}\right) - \left(\hat{i}+\hat{j}\right)$
$\vec{v}_{B/A} = \left(3\hat{i}-4\hat{j}\right)$
$\left|\vec{v}_{B/A}\right| = 5$ m/s

**(13) Answer :** (3)
**Solution:**
Horizontal component of velocity will remain same and vertical component of velocity will be reversed.
$\therefore \ \vec{v} = \left(10\hat{i} - 20\hat{j}\right)$ m/s

**(14) Answer :** (4)
**Solution:**
$h = \frac{v^2}{2g}$
$h = \frac{(3)^2}{20}$
$= 0.45$ m

**(15) Answer :** (1)
**Solution:**
$a = \frac{\left|\vec{v}_f - \vec{v}_i\right|}{t} = \frac{\sqrt{30^2+40^2}}{10} = 5 \text{ m/s}^2$

**(16) Answer :** (4)
**Solution:**
$\vec{r} = \vec{r}_0 + \vec{u}t + \frac{1}{2}\vec{a}t^2$
$= \left(3\hat{i}+4\hat{j}\right) + \frac{1}{2}\left(2\hat{i}\right) \times \left(2\right)^2$

$= (7\hat{i} + 4\hat{j})\text{m}$

**(17) Answer :** (2)
**Solution:**
Velocity is minimum at topmost point. So, linear momentum will also be minimum at topmost point.

**(18) Answer :** (2)
**Solution:**
• A body can exert force (field force) on another body from a distance.
• If a body is in uniform motion i.e., $\vec{v}$ = constant, then $\left|\vec{a}\right| = 0$. Hence, no force is required.

**(19) Answer :** (2)
**Hint:**
Newton's second law.
**Solution:**
$F = ma = m\left(\frac{v-u}{t}\right) = \frac{mv-mu}{t}$
$F = \frac{\Delta p}{\Delta t}$
$F = ma$ has SI unit kg m/s$^2$.

**(20) Answer :** (4)
**Solution:**
$\vec{p} = m\vec{v} = \left(8t\,\hat{i}\right)$ kg m s$^{-1}$

**(21) Answer :** (4)
**Solution:**
$\vec{P} = 3\hat{i} + 2\hat{j}$ and $\vec{Q} = 4\hat{i} + 5\hat{i}$
$\left|\vec{P} + \vec{Q}\right| = \sqrt{7^2 + 7^2} = 7\sqrt{2}$

**(22) Answer :** (4)
**Solution:**
A vector can have infinite component vectors.

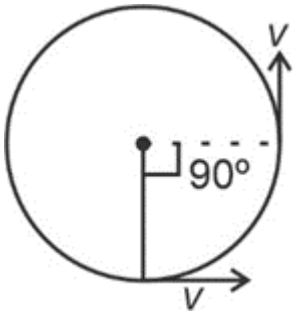
**(23) Answer :** (3)
**Solution:**
$\vec{A} = 2\hat{i} + 3\hat{j}$
$\tan\theta = \frac{A_y}{A_x} = \frac{3}{2}$
$\theta = \tan^{-1}\left(\frac{3}{2}\right)$

**(24) Answer :** (4)
**Solution:**
$T - mg = ma$
$a = \frac{32000 - 2000\times 10}{2000} = 6.0\ m/s^2\left(\text{upwards}\right)$

**(25) Answer :** (3)
**Solution:**
$T = 5g$
friction $f = T$ and $f \le \mu mg$
$\Rightarrow 5g \le \mu mg$
$5g \le \frac{5}{10} \times m \times g$
$m \ge 10$
$\therefore m_{min} = 10$ kg

**(26) Answer :** (2)
**Solution:**
Impulse = change in linear momentum
$= p_f - p_i = \left(mv\cos\hat{i} - mv\sin\theta\hat{j}\right) - \left(-mv\cos\hat{i} - mv\sin\theta\hat{j}\right)$
$= 2mv\cos\theta$

**(27) Answer :** (1)
**Solution:**




Change in velocity ($\Delta v$) $= 2v \sin\left(\frac{\theta}{2}\right) = \sqrt{2}\, v$

**(28) Answer :** (3)
**Solution:**
$\overrightarrow{P_f} = \overrightarrow{P_i}$
$6 \times 10 + 4 \times \vec{V} = 0$
$\vec{V} = -15 \text{ m/s}$
$|\vec{V}| = 15 \text{ m/s}$

**(29) Answer :** (3)
**Solution:** $\overrightarrow{a} = \frac{d\overrightarrow{v}}{dt} = (6 - 8t)\hat{i} \ = (6 - 16)\hat{i} \ = -10\hat{i}$

**(30) Answer :** (3)
**Solution:**
Swimming is possible on account of Newton's third law of motion

**(31) Answer :** (3)
**Solution:**
α + 2 = 4
α = 2

**(32) Answer :** (4)
**Solution:**
$y = x \tan\theta \left(1 - \frac{x}{R}\right)$
$= 4x \left(1 - \frac{x}{2}\right)$
⇒ $R$ = 2 m

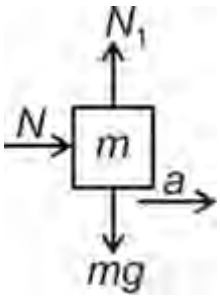
**(33) Answer :** (4)
**Solution:**
$F = nmv$
= 10 × 0.3 × 10 = 30 N

**(34) Answer :** (1)
**Solution:**
$F_{net} = M_{total}a$
100 = (5 + 3)$a$
$a = \frac{100}{8} \text{ m/s}^2$
$T_2 = 5 \times \frac{100}{8} = \frac{500}{8} = 62.5 \text{ N}$
$T_2 = 62.5 \text{ N}$

**(35) Answer :** (2)
**Solution:**
$T = \frac{2 \times u_y}{g} = \frac{2 \times 10}{10} = 2\ s$

**SECTION-B**

**(36) Answer :** (1)
**Solution:**




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

$N = ma$

$N = 5 \times 4 = 20\ \text{N}$

**(37)** **Answer :** (2)
**Solution:**

$\mu = \tan\theta \Rightarrow \mu = \tan 60^\circ = \sqrt{3}$

**(38)** **Answer :** (1)
**Solution:**

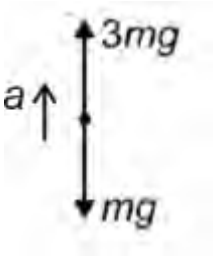
If $\vec{A} + \vec{B} = \vec{A} - \vec{B}$, then $\vec{B}$ must be null vector.

**(39)** **Answer :** (3)
**Solution:**

$T = mg\sin\theta$

$T = 10 \times 10 \times \frac{1}{\sqrt{2}} = 50\sqrt{2}\,\text{N}$

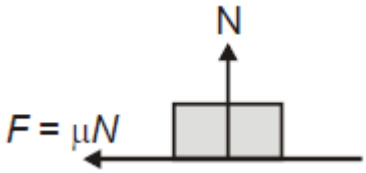
**(40)** **Answer :** (2)
**Solution:**




$3mg - mg = ma$

$a = 2g$

**(41)** **Answer :** (4)
**Solution:**




$R = \sqrt{N^2 + \mu^2 N^2} = N\sqrt{1+\mu^2}$

$= 40\sqrt{1+(0.5)^2} = 20\sqrt{5}$ N

**(42)** **Answer :** (1)
**Solution:**

$\vec{F} = \left[\left(6\hat{i} + 8\hat{j}\right) + 4\hat{i} + 4\hat{j}\right]$ N

$= \left(10\hat{i} + 12\hat{j}\right)$ N

$= 2\ \vec{a}$

$\vec{a} = \left(5\hat{i} + 6\hat{j}\right)$ m/s$^2$

**(43)** **Answer :** (4)
**Solution:**

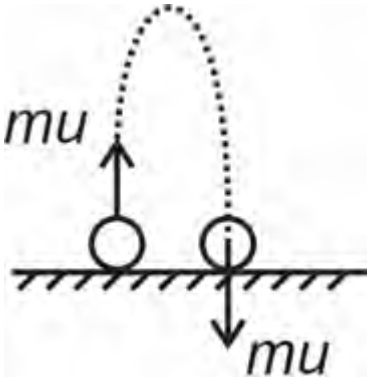
$t = \sqrt{\frac{2\times 80}{10}} = 4$ second

Distance travelled in 4 second, $d = 10 \times 4 = 40$ m

**(44) Answer :** (3)
**Solution:**
$\vec{A} + \vec{B} = 5\hat{i} + 5\hat{j} + 5\hat{k}$
$\therefore$ Unit vector $\frac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$

**(45) Answer :** (2)
**Solution:**
$v_{\max} \leq \sqrt{\mu r g}$
$\Rightarrow \mu \geq \frac{v_{\max}^2}{rg} = \frac{100}{20\times 10} = 0.5$
$\Rightarrow \mu_{\max} = 0.5$

**(46) Answer :** (3)
**Solution:**




magnitude of momentum is same only direction is reverse.

**(47) Answer :** (3)
**Solution:**
$x = 2t$
$y = 3t - 5t^2$
$\therefore\ y = \frac{3x}{2} - \frac{5x^2}{4}$
$\Rightarrow 4y = 6x - 5x^2$

**(48) Answer :** (1)
**Solution:**
Acceleration of a projectile relative to another projectile
$= \vec{g} - \vec{g} = 0$
$\Rightarrow$ Path of projectile as seen from other is straight.

**(49) Answer :** (3)
**Solution:**
To cross the river in minimum time, boat should be row perpendicular to the direction of flow of river.

**(50) Answer :** (2)
**Solution:**
$U_{\text{avg}} = u\cos\theta = u \times \cos 45^\circ = \frac{u}{\sqrt{2}}$

## CHEMISTRY

### SECTION-A

**(51) Answer :** (4)
**Solution:**

| Series | Spectral region |
|---|---|
| Pfund | IR |
| Brackett | IR |
| Paschen | IR |
| Balmer | Visible |

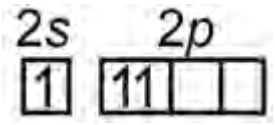
**(52) Answer :** (4)
**Solution:**
Number of protons = Atomic number (Z)
Number of neutrons = Mass number (A) – Atomic number(Z)
In $^{32}_{16}S^{2-}$:
Number of electrons = 16 + 2 = 18
Number of protons = Z = 16
Number of neutrons = A – Z
= 32 – 16 = 16

**(53) Answer :** (4)
**Hint:**
$\lambda = \frac{h}{mv}$
**Solution:**
$\lambda = \frac{6.6\times10^{-34}}{0.132\times2\times10^{5}}$ = 2.5 × $10^{-38}$ m

**(54) Answer :** (2)
**Solution:**
Cr = [Ar]$4s^1 3d^5$
Cu = [Ar]$4s^1 3d^{10}$
⇒ 5 : 10 ⇒ 1 : 2

**(55) Answer :** (2)
**Solution:**
KE(max) = (hν – $h\nu_0$)
Greater the difference in the frequency of incident radiation and threshold frequency, higher is the kinetic energy of the photoelectron.

**(56) Answer :** (4)
**Solution:**




It violates all the rules

**(57) Answer :** (2)
**Solution:**
$\bar{v} = \frac{1}{\lambda} = \frac{v}{c} = \frac{9\times10^{18}}{3\times10^{8}} = 3\times10^{10}\,m^{-1}$

**(58) Answer :** (1)
**Solution:**
Value of l can be 0, 1, 2 …..(n – 1)
m lies between –l and +l
Values of s can be = $+\frac{1}{2}$ or $-\frac{1}{2}$

**(59) Answer :** (2)
**Solution:**
For one electron species energies of various orbital's follows
$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f < ..$

**(60) Answer :** (2)
**Solution:**

| n | *l* | Orbital |
|---|---|---|
| 2 | 1 | 2*p* |
| 3 | 2 | 3*d* |
| 1 | 0 | 1*s* |
| 3 | 1 | 3*p* |

**(61) Answer :** (1)
**Solution:**
$v = 2.188\times10^{8}\times\frac{z}{n}\,cms^{-1}$
$v = 2.188\times10^{8}\times\frac{1}{2}$
$= 1.094\times10^{8}\,cms^{-1}$

**(62) Answer :** (3)

**Solution:**

Mn(25) = [Ar] $4s^2$, $3d^5$

$Mn^{4+}$ = [Ar] $3d^3$

So, 3 unpaired electrons.

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

**Solution:**

$\frac{1}{\lambda} = R_H(3)^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = R_H(1)^2 \left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

$\frac{3^2}{n_1^2} = \frac{1}{2^2} \Rightarrow n_1 = 6$

$\frac{(3)^2}{n_2^2} = \frac{1}{3^2} \Rightarrow n_2 = 9$

**(64) Answer :** (3)

**Solution:**

n = 4, l = 3 represents 4f orbitals.

*f*-subshell can have maximum of 14 $e^-$.

**(65) Answer :** (1)

**Solution:**

NO and $O_2^+$ have 15 electrons each hence they are isoelectronic species.

**(66) Answer :** (3)

**Solution:**

$\lambda \propto \frac{1}{Energy}$

Energy change is maximum for $n_4 \rightarrow n_1$

**(67) Answer :** (2)

**Solution:**

Shape of p-orbital is dumb-bell.

**(68) Answer :** (1)

**Solution:** Answer (1)

The characteristics of cathode rays do not depend upon the material of electrodes used.

**(69) Answer :** (1)

**Solution:**

Number of angular node = l

for 3*d* orbital l = 2

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

**Solution:**

KE = h( $\nu - \nu_0$)

$= 6.6 \times 10^{-34} (3 \times 10^{14} - 1.5 \times 10^{13})$

$= 6.6 \times 10^{-34} \times 28.5 \times 10^{13}$

$= 1.88 \times 10^{-19}$ J

**(71) Answer :** (1)

**Solution:**

$E = N_A \times h\nu$

$= 6.02 \times 10^{23} \times 6.6 \times 10^{-34} \times 10^{15}$

$= 39.7 \times 10^4$

$= 3.97 \times 10^5$ J

$\simeq 4 \times 10^5$ J

**(72) Answer :** (1)

**Solution:**

Due to the smaller size and high electron density F has lesser electron gain enthalpy than Cl.

**(73) Answer :** (2)

**Solution:**

Element B is fluorine. It is most electronegative element

**(74) Answer :** (3)

**Solution:**

$16^{th}$ group elements are known as chalcogens.

$16^{th}$ group elements belong to representative elements.

**(75) Answer :** (4)
**Solution:**
For the different groups of *p*-block different electronic configuration exists. The general electronic configuration for *p*-block elements is
$ns^2\ np^{1-6}$

**(76) Answer :** (1)
**Solution:**
$O^- + e^- \rightarrow O^{2-}$ is endothermic.

**(77) Answer :** (2)
**Solution:**
Higher is the effective nuclear charge, smaller is the size of ion.
$O^{2-}$ and $Mg^{2+}$ both have 10 electrons hence they are isoelectronic species.
Effective nuclear charge of $Mg^{2+}$ is higher than $O^{2-}$ hence ionic size of $Mg^{2+}$ is smaller than $O^{2-}$.

**(78) Answer :** (2)
**Solution:**
Elements after uranium (Z = 92) are referred as transuranium elements.
$\underset{\{\text{Plutonium}\}}{\text{Pu}(Z = 94)} - \text{transuranium element.}$

**(79) Answer :** (4)
**Solution:**
Group 18 elements are called Noble gas.

**(80) Answer :** (2)
**Solution:**
Oxide formula = $M_2O_3$
Hence the valency of metal is three and oxidation state is +3. Therefore the formula of nitride would be $M^{3+}N^{3-} \Rightarrow MN$

**(81) Answer :** (2)
**Solution:**
F $\rightarrow$Most E.N element
Cl $\rightarrow$highest – ve E.G.E.

**(82) Answer :** (4)
**Solution:**
HF with atomic number 72 is a *d*-block element.

**(83) Answer :** (2)
**Solution:**
Ga is known as eka-aluminium.

**(84) Answer :** (2)
**Hint:**
Ytterbium is lanthanoid series element.
**Solution:**
Yb (70) : $[\text{Xe}]4f^{14}5d^06s^2$

**(85) Answer :** (4)
**Solution:**
Electron gain enthalpy = – Ionization enthalpy

**SECTION-B**

**(86) Answer :** (2)
**Solution:**
Orbital angular momentum = $\sqrt{l(l+1)}\,\frac{h}{2\pi}$
For *p*-orbital, $l = 1$
∴ Orbital angular momentum
= $\sqrt{1\,(1+1)}\,\frac{h}{2\pi} = \frac{h}{\sqrt{2}\pi}$

**(87) Answer :** (4)
**Solution:**
E = 200 J, $\lambda = 800\ \text{nm}$
$E = \frac{Nhc}{\lambda}$
$N = \frac{E\lambda}{hc} = \frac{200\times800\times10^{-10}\text{m}}{6.626\times10^{-34}\text{J.s}^{-1}\times3\times10^{8}\ \text{ms}^{-1}}$

$N = 8 \times 10^{19} s^{-1}$

**(88) Answer :** (1)
**Solution:**
$\Delta v = 30 \times \frac{1}{100} = 0.3$

$\Delta x = \frac{h}{4\pi m \Delta v} = \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 50 \times 10^{-3} \times 0.3}$

$= 3.5 \times 10^{-33}$ m

**(89) Answer :** (3)
**Solution:**
The effect of Heisenberg uncertainty principle is significant only for the motion of microscopic objects and is negligible for that of macroscopic object.

**(90) Answer :** (1)
**Solution:**

$\Delta x \times \Delta p = \frac{h}{4\pi}$

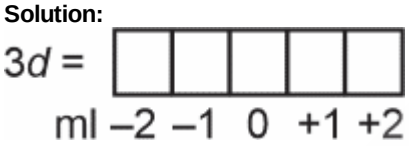
$\Delta p = \frac{h}{4\pi \Delta x}$

$= \frac{h}{4\pi \times 0}$

$\therefore \Delta p = \infty$

**(91) Answer :** (3)
**Solution:**
Angular momentum $= \frac{nh}{2\pi}$
Where possible values n can be 1, 2, 3 ... ∞.

**(92) Answer :** (2)
**Solution:**




Maximum 2 electrons occupied by $m_\ell = 0$.

**(93) Answer :** (1)
**Solution:**
Diffraction and interference are explained by wave nature of electromagnetic radiation.

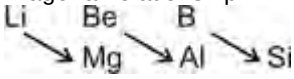
**(94) Answer :** (4)
**Hint:**
He and Ne are having positive electron gain enthalpy.
**Solution:**
Sulphur has most negative electron gain enthalpy among the given elements.

**(95) Answer :** (1)
**Solution:**
Among oxides of carbon, CO is neutral while $CO_2$ is acidic.

**(96) Answer :** (1)
**Solution:**
For isoelectronic species, as the atomic number increases, ionic radii decreases.

**(97) Answer :** (4)
**Solution:**
After removal of first electron, removal of second electron requires more energy and hence second ionisation enthalpy is more than that of first ionisation.

**(98) Answer :** (2)
**Solution:**
Diagonal relationship :




**(99) Answer :** (2)
**Solution:**
$Be'$ and N' have comparatively more stable electronic configuration than $B'$ and O'.
∴ Correct order of first ionisation enthalpy is:

Li < B < Be < C < O < N < F < Ne

**(100) Answer :** (2)
**Solution:**
The IUPAC name of an element with atomic number 106 is unnilhexium.

## BOTANY

### SECTION-A

**(101) Answer :** (2)
**Solution:**
Anaphase is the phase where chromatids move towards the pole.

**(102) Answer :** (3)
**Solution:**
Cells at the end of prophase do not show Golgi complex; endoplasmic reticulum, nucleolus and the nuclear envelope.

**(103) Answer :** (1)
**Solution:**
Prophase I is divided into five sub phases.

**(104) Answer :** (3)
**Solution:**
During metaphase chromosomes get attached to spindle fibres.

**(105) Answer :** (3)
**Solution:**
Most of the cell organelles duplicate in $G_1$ phase. DNA duplicates in S phase and semiautonomous organelles duplicate in $G_2$ phase.

**(106) Answer :** (3)
**Solution:**
Chromosomes are elongated but do not form chromatin fibre and there is no replication of DNA. In plant centrioles are absent.

**(107) Answer :** (4)
**Solution:**
Synthesis of histone protein takes place in S phase.

**(108) Answer :** (1)
**Solution:**
Prophase (c) $\longrightarrow$ Metaphase (b) $\longrightarrow$ Anaphase (d) $\longrightarrow$ Telophase (a)

**(109) Answer :** (1)
**Solution:**
$G_2$ is metabolically active stage. In S phase, DNA amount doubles but not chromosome number.
During zygotene pairing of homologous chromosomes and formation of synaptonemal complex occur.

**(110) Answer :** (1)
**Solution:**
Shape of chromosome is studied in anaphase.

**(111) Answer :** (2)
**Solution:**
Crossing over occurs between the non-sister chromatids of homologous chromosomes.

**(112) Answer :** (4)
**Solution:**
Haploid cells are formed by meiosis. Zygotes are formed through fertilization.

**(113) Answer :** (3)
**Solution:**
Due to repeated Karyokinesis without cytokinesis, multinucleate condition of the cell develops. This stage is called syncytium.

**(114) Answer :** (1)
**Solution:**
• A bivalent or a tetrad includes four chromatids.
• Bivalent is a pair of homologous chromosomes.

**(115) Answer :** (2)
**Solution:**
Lion, leopard and tiger all are species of the genus *Panthera*.

**(116) Answer :** (3)
**Solution:**
In bacteria growth and reproduction are inclusive events. Growth may be shown by sand dunes and mountains.

**(117) Answer :** (2)
**Solution:**
True regeneration can be seen in *Planaria* in given examples.

**(118) Answer :** (1)
**Solution:**
*Mangifera* (Genus) $\rightarrow$Anacardiaceae (Family) $\rightarrow$Sapindales (Order) $\rightarrow$Dicotyledonae (Class) $\rightarrow$Angiospermae (Division).

**(119) Answer :** (2)
**Solution:**
Worker bees are sterile.

**(120) Answer :** (1)
**Solution:**
First word in a biological name indicates genus of the organism.

**(121) Answer :** (4)
**Solution:**
Self-consciousness is shown by human beings only.

**(122) Answer :** (2)
**Solution:**
Family are characterised on the basis of common vegetative and reproductive features. *Datura*, *Petunia* and *Solanum* belongs to family Solanaceae.

**(123) Answer :** (2)
**Solution:**
All the three words (generic name, specific epithet and authors citation) collectively form binomial epithet.
The correct binomial epithet of mango is *Mangifera indica* Linn.

**(124) Answer :** (3)
**Solution:**
Consciousness is a defining feature.
Prokaryotes are truly living organisms, they can also sense and respond to environmental cues.

**(125) Answer :** (3)
**Solution:**
Nutritionally plants are autotrophs but fungi are heterotrophs

**(126) Answer :** (3)
**Solution:**
Algae are photosynthetic and fungi are non-photosynthetic.

**(127) Answer :** (4)
**Solution:**
*Chlorella* and *Amoeba* are unicellular eukaryotic organisms placed in the kingdom protista.

**(128) Answer :** (2)
**Solution:**
Kingdom Monera includes prokaryotes.
Other four kingdoms Protista, Fungi, Plantae and Animalia include eukaryotes.

**(129) Answer :** (3)
**Solution:**
Linnaeus classified all living organisms into two kingdoms – plantae and animalia.
The criteria for classification used by him includes, cell wall, locomotion, mode of nutrition, response to external stimuli and contractile vacuole.
Cell structure (either prokaryotic or eukaryotic) was the basis of classification in R. H. Whittaker's five kingdom classification.

**(130) Answer :** (3)
**Solution:**
Cellulosic cell wall is found in plants.
Cell wall in monerans (except Archaebacteria and *Mycoplasma*) is made up of peptidoglycan and cell wall in fungi is made up of chitin.

**(131) Answer :** (2)

**Solution:**
Locomotion is not a criterion in R.H. Whittaker's five kingdom classification.

**(132) Answer :** (4)
**Solution:**
Archaebacteria differ from other bacteria in having a different cell wall structure.

**(133) Answer :** (3)
**Solution:**
Kingdom Monera includes all prokaryotes and they show many different types of mode of nutrition.

**(134) Answer :** (4)
**Solution:**
Monerans lack membrane bound organelles. Their cell wall is made up of peptidoglycan except in Archaebacteria and *Mycoplasma*.

**(135) Answer :** (3)
**Solution:**
Systematics is derived from Latin word.

**SECTION-B**

**(136) Answer :** (3)
**Solution:**
DNA duplicates in S phase.
So, $G_1 \rightarrow S \rightarrow G_2$
20 pg → 40 pg → 40 pg

**(137) Answer :** (2)
**Solution:**
Chromatids separate during anaphase or anaphase II.

**(138) Answer :** (4)
**Solution:**
Bacteria show amitosis and lack spindle fibres.

**(139) Answer :** (4)
**Solution:**
Meiosis brings variations and produces recombinants.

**(140) Answer :** (1)
**Solution:**
Four haploid cells are formed after meiosis II.

**(141) Answer :** (1)
**Solution:**
(i) Anaphase-I
(ii) Pachytene
(iii) Metaphase-I
(iv) Anaphase-II
Correct sequence will be (ii) → (iii) → (i) → (iv)

**(142) Answer :** (2)
**Solution:**
Convolvulaceae and Solanaceae are included in the order Polymoniales mainly based on the floral characters.

**(143) Answer :** (1)
**Solution:**
Scientific name of plants are standardised by ICBN. (International code for Botanical Nomenclature)

**(144) Answer :** (2)
**Solution:**
The ascending order of taxonomic hierarchy is
Species → Genus → Family → Order → Class → Division → Kingdom

**(145) Answer :** (3)
**Solution:**
Taxonomy is the branch of science which deals with study of principles and procedures of grouping of organism.

**(146) Answer :** (2)
**Solution:**
The number of similar characteristics goes on decreasing from species to kingdom.

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

Every living organism shows consciousness.

**(148) Answer :** (4)
**Solution:**
Obligate anaerobes show anaerobic mode of respiration only.

**(149) Answer :** (3)
**Solution:**
Loose tissue body organisation can be represented by mycelium of fungi.

**(150) Answer :** (2)
**Solution:**
Aristotle used simple morphological characters to classify plants into herbs, shrubs and trees.

## ZOOLOGY

### SECTION-A

**(151) Answer :** (1)
**Solution:**
Haem is a co-factor for enzyme peroxidase and catalase.

**(152) Answer :** (1)
**Solution:**
Proteins are heteropolymers.

**(153) Answer :** (1)
**Solution:**
The nasal chamber opens into the pharynx; a portion of which is the common passage for food and air. The pharynx opens through the larynx region into the trachea.

**(154) Answer :** (4)
**Solution:**
Fatty acids are found esterified with glycerol. Many lipids have both glycerol and fatty acids.

**(155) Answer :** (3)
**Solution:**
Guanine pairs with cytosine and adenine pairs with thymine in a DNA molecule.

**(156) Answer :** (2)
**Solution:**
In humans, trachea extends upto the mid-thoracic cavity as a straight tube and divides into right and left primary bronchi at the level of $5^{th}$ thoracic vertebra.

**(157) Answer :** (2)
**Solution:**
Enzymes are denatured or degraded at high temperature.

**(158) Answer :** (3)
**Solution:**
First amino acid is present at left end of a polypeptide chain and is called N-terminal amino acid.

**(159) Answer :** (4)
**Solution:**
Enzyme-substrate complex passes through transition state to produce product and enzyme again becomes free.

**(160) Answer :** (1)
**Solution:**
Cytidylic acid is present in RNA and DNA whereas uridylic acid is present only in RNA.

**(161) Answer :** (3)
**Solution:**

$\frac{\text{Total length of DNA}}{3.4}$

$= \frac{170}{3.4} = 50$ bp. (base pairs)

**(162) Answer :** (2)
**Solution:**
Each enzyme (E) has a substrate (S) binding site in its molecule so that a highly reactive enzyme-substrate complex (ES) is produced. This complex is short-lived and dissociates into its product(s) 'P' and the unchanged enzyme with an intermediate formation of the enzyme-product complex (EP).

**(163) Answer :** (2)
**Solution:**
Each enzyme shows its highest activity at a particular pH called optimum pH

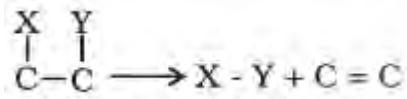
**(164) Answer :** (1)
**Solution:**
**Hint :** Almost all enzymes are proteins.
**Sol.:** Ribozyme and ribonuclease both have catalytic power.
High temperature can cause denaturation of proteins.

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

**(166) Answer :** (1)
**Solution:**
In Watson-Crick model of B-DNA, at each step of ascent, the strand turns 36°. One full turn of the helical strand would involve 10 steps or 10 base pairs.

**(167) Answer :** (2)
**Solution:**
A peptide linkage is formed by the removal of a water molecule when two amino acids are joined together.

**(168) Answer :** (4)
**Hint:**
Protease acts by hydrolysis.
**Solution:**
Most of the enzymes involved in the process of digestion belong to class hydrolases.
**Oxidoreductases/dehydrogenases:** Enzymes which catalyse oxidoreduction between two substrates S and S' *e.g.*,
S reduced + S' oxidised $\rightarrow$ S oxidised + S' reduced
**Transferases:** Enzymes catalysing a transfer of a group, G (other than hydrogen) between a pair of substrate S and S' *e.g.*,
S - G + S' $\rightarrow$ S + S' - G
**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.

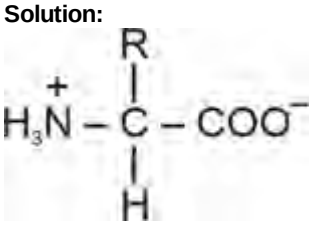


**(169) Answer :** (2)
**Solution:**
All are chemically proteins.

**(170) Answer :** (1)
**Solution:**
Normal expiration occurs due to relaxation of external intercostal muscles and diaphragm.

**(171) Answer :** (2)
**Solution:**
Earthworms use their moist cuticle for exchange of gases and insects have a network of tubes (tracheal tubes) to transport atmospheric air within the body.

**(172) Answer :** (3)
**Solution:**



(Zwitterionic form of an amino acid)

**(173) Answer :** (1)
**Solution:**
Whole of respiratory system is divided into two parts-conducting part and respiratory part.

**(174) Answer :** (1)
**Solution:**
The part starting with the external nostrils up to the terminal bronchioles constitute the conducting part whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system.

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**(175) Answer :** (4)
**Solution:**
During normal inspiration and expiration, major role is played by diaphragm and external inter-costal muscles.
In forceful expiration, internal inter-costal muscles and abdominal muscles also contract.

**(176) Answer :** (2)
**Solution:**
Epiglottis covers glottis during swallowing of food.

**(177) Answer :** (3)
**Solution:**
Lungs are placed in air tight thoracic cavity. Space between two pleura is known as pleural space/pleural cavity containing pleural fluid.

**(178) Answer :** (1)
**Solution:**
Prosthetic groups are organic compounds and are tightly bound to the apoenzyme.
*e.g*. Haem in catalase.

**(179) Answer :** (4)
**Solution:**
Tracheal cartilage allows it to move and flex during breathing.

**(180) Answer :** (3)
**Solution:**
Breathing or pulmonary ventilation is first step of respiration by which atmospheric air is drawn in and $CO_2$ rich alveolar air is released out.

**(181) Answer :** (1)
**Solution:**
Holoenzyme = Apoenzyme + Co-factor
(Active) (Inactive)

**(182) Answer :** (1)
**Solution:**
In lysine, –R group is $–CH_2– CH_2– CH_2– CH_2–NH_2$.

**(183) Answer :** (1)
**Solution:**
Structures called gills (branchial respiration) are used by most of the aquatic arthropods and molluscs.

**(184) Answer :** (3)
**Solution:**
Phospholipid is made up of 2 fatty acids attached to one glycerol molecule which is also attached to a phosphate group.

**(185) Answer :** (2)
**Solution:**
Breathing rate is nearly 40 times per minute in newly born.

**SECTION-B**

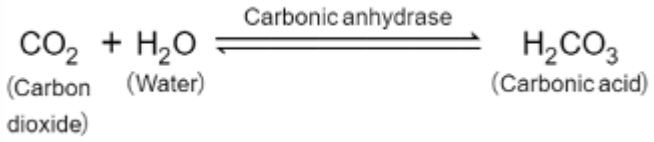
**(186) Answer :** (1)
**Solution:**
Competitive inhibition could be reversed by increasing the concentration of substrate.

**(187) Answer :** (2)
**Solution:**
The substrate binds to the active site of the enzyme for which it has to diffuse towards the active site. There is an obligatory formation of an enzyme-substrate complex. This complex formation lasts only for a short time and is a transient phenomenon.

**(188) Answer :** (2)
**Solution:**
Receptors are proteins, usually cell surface receptors, which bind to ligands and cause responses in the immune system, including cytokine receptors, growth factor receptors, *etc*.

**(189) Answer :** (4)
**Solution:**
$K_m$ refers to the substrate concentration at which velocity of a reaction reaches $V_{max}/2$.

**(190) Answer :** (2)
**Solution:**




**(191) Answer :** (4)
**Solution:**
Trachea is a straight tube extending up to the mid-thoracic cavity, which divides at the level of $5^{th}$ thoracic vertebra ($T_5$).

**(192) Answer :** (3)
**Solution:**
A nucleotide has three chemically distinct components. One is a heterocyclic compound, the second is a monosaccharide and the third is a phosphoric acid or phosphate.

**(193) Answer :** (3)
**Solution:**
Glycine has no asymmetric carbon because it has two hydrogen atoms attached to alpha carbon.

**(194) Answer :** (4)
**Solution:**
There are four substituent groups occupying the four valency positions. These are hydrogen, carboxyl group, amino group and a variable R group. Based on the nature of R group, there are many types of amino acids.

**(195) Answer :** (1)
**Solution:**
Incomplete cartilaginous rings are present upto initial bronchioles.

**(196) Answer :** (3)
**Solution:**
Sacrum is the vertebral bone.

**(197) Answer :** (2)
**Solution:**
During expiration, relaxation of muscles brings the ribs and sternum back to normal position which reduces the volume of thoracic chamber. This leads to increase in intra pulmonary pressure - positive pressure in lungs with respect to atmospheric pressure.

**(198) Answer :** (3)
**Solution:**
The process of exchange of $O_2$ from the atmosphere with $CO_2$ produced by the cells is called breathing.

**(199) Answer :** (3)
**Solution:**
Expiration is the moving of air out of lungs when the pressure within the lungs is more than the atmospheric pressure.
The route of air is :- Alveoli → Bronchioles → Bronchi → Trachea → Larynx → Pharynx → Nasal cavities → External nostrils.

**(200) Answer :** (2)
**Solution:**
Ligases catalyse the joining of C–O, C–S, C–N, *etc*., bonds.