

# Physics

1

Determine the angular speed of earth, so that body lying on equator may appear weightlessness. ( $g = 10 \text{ m/s}^2$ ,  $R = 6400 \text{ km}$ )

1

$$\frac{1}{100} \text{ rad/s}$$

2

$$\frac{1}{400} \text{ rad/s}$$

3

$$\frac{1}{600} \text{ rad/s}$$

4

$$\frac{1}{800} \text{ rad/s}$$

2

Surface of the lake is at  $2^\circ\text{C}$ . Then what is the temperature of the bottom of the lake?

1

$$1^\circ\text{C}$$

2

$$4^\circ\text{C}$$

3

$$3^\circ\text{C}$$

4

$$2^\circ\text{C}$$

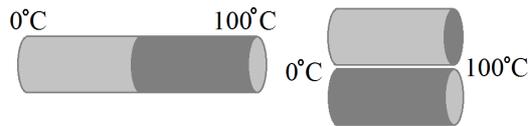
3

An alternating current source of frequency  $100 \text{ Hz}$  is joined to a combination of a resistance, a capacitance and a coil in series. The potential difference across the coil, the resistance and the capacitor is  $46$ ,  $8$  and  $40$  volt respectively. What is the electromotive force of alternating current source (in volt)?

1	10
2	14
3	76
4	92

4

2-identical square rods of metal are welded end to end as shown in figure (i), 20 calories of heat flows through it in 4 minutes. When the rods are welded as shown in figure (ii), then calculate the time in which the same amount of heat will flow through the rods.



1	16 minutes
2	1 minute
3	2 minutes
4	4 minutes

5

A man can swim a speed of  $4 \text{ km h}^{-1}$  in still water. Estimate how long does he take to cross a river 1 km wide if the river flows steadily at  $3 \text{ km h}^{-1}$  and he makes his strokes normal to the river current.

1	20 min
2	15 min
3	10 min
4	5 min

6

Same force acts on two bodies of different masses 3 kg and 5 kg initially at rest. What is the ratio of times required to acquire same final velocity?

1	9 : 25
2	25 : 9
3	5 : 3
4	3 : 5

7

An object is kept on a smooth inclined plane of 1 in l. \_\_\_\_\_ is the horizontal acceleration to be imparted to the inclined plane so that the object is stationary relative to the incline.

1	$\frac{g}{l^2 - 1}$
---	---------------------

2

$$g(l^2 - 1)$$

3

$$\frac{g}{\sqrt{l^2 - 1}}$$

4

$$g\sqrt{l^2 - 1}$$

8

Define centre of mass.

1

A point where the whole mass of the body is supposed to be concentrated

2

A point which is the origin of reference frame

3

A point which is geometric centre of a body

4

A point from which distance of particles are same

9

Masses of three wires of copper are in the ratio of 1:3:5 and their lengths are in the ratio of 5:3:1. What is the ratio of their electrical resistances?

1

125:15:1

2

1:15:125

3

5:3:1

4

1:3:5

10

A body of mass 40 kg resting on a rough horizontal surface is subjected to a force  $F$  which is just enough to start the motion of the body. If  $\mu_s = 0.5, \mu_k = 0.4$  and the force  $F$  is continuously applied on the body, then what is the acceleration of the body? (Take  $g = 10 \text{ m s}^{-2}$ )

1

 $2.4 \text{ m s}^{-2}$ 

2

 $1 \text{ m s}^{-2}$ 

3

 $2 \text{ m s}^{-2}$ 

4

0

11

Which of the following statement is correct?

1

A body having zero velocity will necessarily have zero acceleration

2

A body having zero velocity will not necessarily have zero acceleration

3

A body having uniform speed can have only uniform acceleration

4

A body having non-uniform velocity will have zero acceleration

12

A man measures time period of a pendulum ( $T$ ) in stationary lift. If the lift moves upward with acceleration  $\frac{g}{4}$ , then what will be the new time period?

1

$$\frac{\sqrt{5}}{2T}$$

2

$$\frac{2}{\sqrt{5}T}$$

3

$$\frac{2T}{\sqrt{5}}$$

4

$$\frac{\sqrt{5}T}{2}$$

13

At  $0^\circ\text{C}$  the density of a fixed mass of a gas divided by pressure is  $x$ . What will be the ratio at  $100^\circ\text{C}$ ?

1

 $x$ 

2

$$\frac{100}{273}x$$

3

$$\frac{273}{373}x$$

4

$$\frac{373}{273}x$$

14

Taking the radius of the earth of be 6400 km, by \_\_\_\_\_ percentage will the acceleration because of gravity at a height of 100 km from the surface of the earth differ from that on the surface of the earth.

1	about 5%
2	about 1.5%
3	about 8%
4	about 3%

15

A steel ring of radius 'r' and cross-section area 'A' is fitted on to a wooden disc of radius R ( $R > r$ ). When Young's modulus is E, then find the force with which the steel ring is expanded.

1	$\frac{E}{A} \left( \frac{R-r}{A} \right)$
2	$AE \frac{R}{r}$
3	$AE \left( \frac{R-r}{r} \right)$
4	$\frac{Er}{AR}$

16

Hydrogen gas is filled in a balloon at 20°C. If temperature is made 40°C, pressure remaining same, then what fraction of Hydrogen will come out?

1	0.75
2	0.5
3	0.25
4	0.07

17

A charge  $Q$  is fixed at each of two opposite corners of a square. A charge  $q$  is placed at each of the other two corners. If the resultant electric force on  $Q$  is zero, then what is the relation between  $Q$  and  $q$ ?

1	$Q = 2\sqrt{2}q$
2	$Q = -2\sqrt{2}q$
3	$Q = -\sqrt{2}q$
4	$Q = \sqrt{2}q$

18

Angular velocities of 3 bodies in simple harmonic motion are  $\omega_1, \omega_2, \omega_3$  with their respective amplitudes as  $A_1, A_2, A_3$ . When all the 3 bodies have same mass and velocity, then choose the correct condition.

1	$A_1^2\omega_1 = A_2^2\omega_2 = A_3^2\omega_3$
---	---

2

$$A_1^2 \omega_1^2 = A_2^2 \omega_2^2 = A^2$$

3

$$A_1 \omega_1 = A_2 \omega_2 = A_3 \omega_3$$

4

$$A_1 \omega_1^2 = A_2 \omega_2^2 = A_3 \omega_3^2$$

19

A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is in proportion with:

1

Y

2

 $Y^2$ 

3

 $1/Y$ 

4

 $1/Y^2$ 

20

Why the earth binds the atmosphere?

1

Due to oxygen between earth and atmosphere

2

Due to gravity

3

Both (1) and (2)

4

None of these

21

Find the amount of work done in blowing a soap bubble such that its diameter increases from  $d$  to  $D$ . ( $T$  = surface tension of the solution)

1

$$\pi(D^2 - d^2)T$$

2

$$2\pi(D^2 - d^2)T$$

3

$$4\pi(D^2 - d^2)T$$

4

$$8\pi(D^2 - d^2)T$$

22

An isolated particle of mass ' $m$ ' is moving in a horizontal plane ( $X$ - $Y$ ) along the  $X$ -axis at a certain height above the ground. It suddenly explodes into 2 fragments of masses  $m/4$  and  $3m/4$ . An instant later, if the smaller fragment is at  $y = 15$  cm, then find the position of larger fragment at this instant.

1

$$y = +20 \text{ cm}$$

2

$$y = -20 \text{ cm}$$

3

$$y = +5 \text{ cm}$$

4

$$y = -5 \text{ cm}$$

23

Pulling force making an angle  $\theta$  to the horizontal is applied on a block of weight  $W$  placed on a horizontal table. When the angle of friction is ' $\alpha$ ', evaluate the magnitude

of force required to move the body.

1

$$\frac{W \tan \alpha}{\sin(\theta - \alpha)}$$

2

$$\frac{W \sin \alpha}{\cos(\theta - \alpha)}$$

3

$$\frac{W \cos \alpha}{\cos(\theta - \alpha)}$$

4

$$\frac{W \sin \alpha}{g \tan(\theta - \alpha)}$$

24

Determine the density  $\rho$  of water of bulk modulus  $B$  at a depth  $y$  in the ocean is related to the density at surface  $\rho_0$ .

1

$$\rho = \rho_0 \left[ 1 - \frac{B}{\rho_0 g y} \right]$$

2

$$\rho = \rho_0 \left[ 1 + \frac{B}{\rho_0 h g y} \right]$$

3

$$\rho = \rho_0 \left[ 1 + \frac{\rho_0 g y}{B} \right]$$

4

$$\rho = \rho_0 \left[ 1 - \frac{\rho_0 g y}{B} \right]$$

25

A conducting ring of radius  $r$  is placed in a varying magnetic field perpendicular to the plane of the ring. If the rate at which the magnetic field varies is  $x$ , what is the electric field intensity at any point of the ring?

1

$rx$

2

$2rx$

3

$\frac{rx}{2}$

4

$\frac{4r}{x}$

26

Certain neutron stars are believed to be rotating at about 1 rev/s. If such a star has a radius of 20 km, then what will be the acceleration of an object on the equator of the star?

1

$4 \times 10^8 \text{ m/s}^2$

2

$8 \times 10^5 \text{ m/s}^2$

3

$20 \times 10^8 \text{ m/s}^2$

4

$120 \times 10^5 \text{ m/s}^2$

27

The centripetal acceleration is calculated by:

1

$vr$

2

$v/r$

3

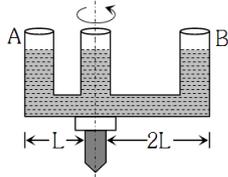
$vr^2$

4

$v^2/r$

28

As shown in figure, a given shaped glass tube having uniform cross section is filled with water and is mounted on a rotatable shaft. What is the resultant if the tube is rotated with a constant angular velocity  $\omega$ ?



1

Water levels remains same in both sections

2

Water level in Section A comes down and that in B it goes up

3

Water level in Section A goes up and that in B comes down

4

Water levels in both sections A and B go up

29

A nichrome wire 50 cm long and  $1 \text{ mm}^2$  in cross-section carries a current of 4 A when connected to a 2 V storage battery. What is the resistivity of nichrome?

1

$5 \times 10^7 \Omega \text{ m}$

2

$4 \times 10^{-7} \Omega \text{ m}$

3

$2 \times 10^{-7} \Omega \text{ m}$

4

$1 \times 10^{-6} \Omega \text{ m}$

30

One mole of an ideal mono-atomic gas is heated at a constant pressure of 1 atmosphere from  $0^\circ\text{C}$  to  $100^\circ\text{C}$ . Then find the change in the internal energy.

1

20.80 joules

2

 $12.48 \times 10^2$  joules

3

 $8.32 \times 10^2$  joules

4

6.56 joules

31

If on heating liquid through  $80^\circ\text{C}$ , the mass expelled is  $(1/100)^{\text{th}}$  of mass still remaining, then find the coefficient of apparent expansion of liquid.

1

$1.25 \times 10^{-5}/^\circ\text{C}$

2

$1.25 \times 10^{-4}/^\circ\text{C}$

3

$12.5 \times 10^{-4}/^\circ\text{C}$

4

None of the above

32

A proton and an alpha particle are separately projected in a region where a uniform magnetic field exists. Their initial velocities are perpendicular to direction of magnetic field. Find the ratio of momentum of proton to alpha particle  $\left(\frac{P_p}{P_\alpha}\right)$ , if both the particles move around magnetic field in circles of equal radii.

1

$\frac{1}{4}$

2

$\frac{1}{2}$

3

1

4

2

33

If a car travels from A to B at a speed of 20 km/hr and returns at a speed of 30 km/hr, then what is the average speed of the car for the whole journey?

1

15 km/hr

2

22 km/hr

3

24 km/hr

4

50 km/hr

34

An object is gently placed on a long conveyer belt moving with a speed of  $5 \text{ m s}^{-1}$ . If the coefficient of friction between the block and the belt is 0.5, the block will slide on the belt up to a \_\_\_\_\_ distance. (Take  $g = 10 \text{ m s}^{-2}$ )

1	3.5 m
2	3.0 m
3	2.5 m
4	2.0 m

35

Two small conducting spheres of equal radius have charges  $+10 \mu\text{C}$  and  $-20 \mu\text{C}$  respectively and kept at a distance  $R$  from each other experience force  $F_1$ . They experience force  $F_2$ , if they are brought in contact and separated to the same distance. What is the ratio  $F_1$  to  $F_2$ ?

1	1:2
2	1:8
3	- 2:1
4	- 8:1

36

An elevator car, whose floor to ceiling distance is equal to 2.7 m, starts ascending with constant acceleration of  $1.2 \text{ ms}^{-2}$ . 2 seconds after the start, a bolt begins falling from the ceiling of the car. Find the free fall time of the bolt.

1	$\sqrt{6} \text{ s}$
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2

$$\sqrt{0.54 \text{ s}}$$

3

1 s

4

0.7 s

37

The quantity which is expressed as force per unit area is:

1

Pressure

2

Work

3

Area

4

Volume

38

When the pressure at half the depth of a lake is equal to  $\frac{2}{3}$  pressure at the bottom of the lake, then what is the depth of the lake?

1

60 m

2

30 m

3

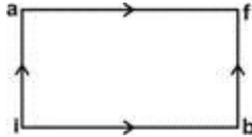
20 m

4

10 m

39

When a system is taken from state i to state f along the path iaf, it is found that  $Q = 50$  cal and  $W = 20$  cal. Along the path ibf,  $Q = 36$  cal. What is  $W$  along the path ibf?



1

66 cal

2

6 cal

3

16 cal

4

14 cal

40

If  $x$ ,  $v$  and  $a$  denote the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period  $T$ , then, \_\_\_ does not change with time.

1

$$\frac{aT}{x}$$

2

$$a^2 T^2 + 4\pi^2 v^2$$

3

$$\frac{aT}{v}$$

4

$$at + 2\pi v$$

41

A force acts on a 30 gm particle in such a way that the position of the particle as a function of time is given by,  $x = 3t - 4t^2 + t^3$ , where 'x' is in metres and 't' is in seconds. How much work is done during the first 4 seconds?

1

530 mJ

2

490 mJ

3

450 mJ

4

5.28 J

42

A force of 5 N, making an angle  $\theta$  with the horizontal, acting on an object displaces it by 0.4 m along the horizontal direction. If the object gains kinetic energy of 1 J, then find the horizontal component of the force.

1

2.5 N

2

3.5 N

3

4.5 N

4

1.5 N

43

A body of mass 'm' hangs at one end of a string of length 'l', the other end of which is fixed. It is given a horizontal velocity so that the string would just reach, where it makes an angle of  $60^\circ$  with the vertical. Then find the tension in the string at mean position.

1

1 mg

2

2 mg

3

3 mg

4

 $\sqrt{3} mg$ 

44

Identify the pairs that have same dimensional formula for both the quantities.

(1) Kinetic energy and torque

(2) Resistance and inductance

(3) Young's modulus and pressure

1

(2) only

2

(1) only

3

(1) and (3) only

4

All of three

45

If at same temperature and pressure, the densities for 2 diatomic gases are respectively  $d_1$  and  $d_2$ , then what will be the ratio of velocities of sound in these gases?

1	$d_1 d_2$
2	$\sqrt{d_1 d_2}$
3	$\sqrt{\frac{d_1}{d_2}}$
4	$\sqrt{\frac{d_2}{d_1}}$

46

Vector  $\vec{A}$  makes equal angles with x, y and z axis. Value of its components (in terms of magnitude of  $\vec{A}$ ) will be

1	$\frac{A}{\sqrt{3}}$
2	$\frac{\sqrt{3}}{A}$
3	$\sqrt{3}A$
4	$\frac{A}{\sqrt{2}}$

47

Two masses  $m_1$  and  $m_2$  ( $m_1 > m_2$ ) are connected by massless flexible and inextensible string passed over massless and frictionless pulley. Then what is the acceleration of centre of mass?

1

$$\frac{m_1 + m_2}{m_1 + m_2} g$$

2

$$\frac{m_1 - m_2}{m_1 + m_2} g$$

3

$$\left( \frac{m_1 - m_2}{m_1 + m_2} \right)^2 g$$

4

0

48

How much work is done in converting one gram of ice at  $-10^\circ\text{C}$  into steam at  $100^\circ\text{C}$ ?

1

616 J

2

721 J

3

3045 J

4

6056 J

49

A body of mass ' $m$ ' is moving in a circle of radius ' $r$ ' with a constant speed ' $v$ '. The force on the body is  $\frac{mv^2}{r}$  and is directed towards the centre. Determine the work done by this force in moving the body over half the circumference of the circle.

1

$$\frac{\pi r^2}{mv^2}$$

2

$$\frac{mv^2}{\pi r^2}$$

3

$$\frac{mv^2}{r^2}$$

4

Zero

50

If  $x$  longitudinal strain is produced in a wire of Young's modulus  $y$ , then find the energy stored in the material of the wire per unit volume.

1

$$\frac{1}{2}yx^2$$

2

$$yx^2$$

3

$$2yx^2$$

4

$$\frac{1}{2}y^2x$$

## Chemistry

1

How many different structural isomers are possible primary amines from  $C_4H_{11}N$ ?

1

6

2

5

3

4

4

3

2

Find the number of unpaired electrons in the  $\text{Fe}^{2+}$  ion.

1

0

2

3

3

4

4

6

3

At 290 K, velocity constant of a reaction was found to be  $3.2 \times 10^{-3}$ . At 300 K it will be

1

 $3.2 \times 10^{-4}$ 

2

 $9.6 \times 10^{-3}$ 

3

 $6.4 \times 10^{-3}$ 

4

 $1.28 \times 10^{-2}$

4

Which of the following species discharged at cathode during electrolysis?

1

Cation

2

Ions

3

Anion

4

All of these

5

What happens when a sulphur atom becomes a sulphide ion?

1

It gains two electrons

2

There is no change in the composition of atom

3

The mass number changes

4

None of these

6

The hydration energy of  $\text{Mg}^{2+}$  is larger than

1

 $\text{Cr}^{3+}$ 

2

 $\text{Al}^{3+}$

3



4



7

What is the percentage ionization for both strong and weak electrolytes at infinite dilution?

1

100%

2

50%

3

20%

4

1%

8

Carbon and oxygen combine to form two oxides, carbon monoxide and carbon dioxide in which the ratio of the weights of carbon and oxygen is respectively 12:16 and 12:32. What does these figures illustrate?

1

Law of reciprocal proportions

2

Law of multiple proportions

3

Law of conservation of mass

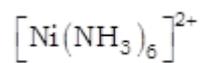
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Law of constant proportions

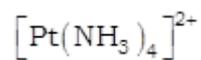
9

\_\_\_\_\_ complex obeys the EAN rule.

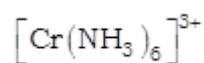
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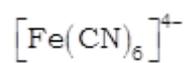
2



3



4



10

The strongest bond is \_\_\_\_.

1



2



3



4



11

The molar solution of sulphuric acid=

1

3 N solution

2

2 N solution

3

N solution

4

N/2 solution

12

Which of the following compounds does not contain  $-OH$  group?

1

Alcohols

2

Aldehydes

3

Carboxylic acid

4

Phenol

13

Find the correct order of density.

1

Sc > Zn > Ni > Cu

2

Zn > Cu > Ni > Sc

3

Ni > Cu > Zn > Sc

4

Cu > Ni > Zn > Sc

14

Insulin contains 3.4% sulphur. What is the minimum molecular weight of insulin?

1

940

2

560

3

470

4

350

15

Which compound is called as oil of winter green?

1

Phenyl salicylate

2

Phenyl benzoate

3

Methyl salicylate

4

Phenyl acetate

16

When rate of the forward reaction becomes equal to the backward reaction, this state is defined as

1	reversible state
2	chemical equilibrium
3	equilibrium
4	all of these

17

What will be the number of molecules at NTP in 1 ml of an ideal gas?

1	$2.69 \times 10^{19}$
2	$2.69 \times 10^{23}$
3	$6 \times 10^{23}$
4	None of these

18

Rate of a gaseous reaction is given by the expression  $k[A][B]$ . What will be the reaction rate relating to original rate if the volume of the reaction vessel is suddenly reduced to the 1/4th of the initial volume?

1	16 times
---	----------

2

8 times

3

1/10 times

4

1/8 times

19

For the reaction  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ ;  $\Delta H$  is equal to

1

 $\Delta U + 2RT$ 

2

 $\Delta U + RT$ 

3

 $\Delta U - 2RT$ 

4

 $\Delta U - RT$ 

20

Carnallite in solution in  $\text{H}_2\text{O}$ , shows the properties of which of the following?

1

 $\text{K}^+, \text{Mg}^{2+}, \text{Cl}^-, \text{Br}^-$ 

2

 $\text{K}^+, \text{Mg}^{2+}, \text{CO}_3^{2-}$ 

3

 $\text{K}^+, \text{Cl}^-, \text{SO}_4^{2-}, \text{Br}^-$ 

4

 $\text{K}^+, \text{Mg}^{2+}, \text{Cl}^-$

21

Solution of sodium metal in liquid ammonia is strongly reducing because of the presence of the following in the solution.

1

Sodium hydride

2

Sodium atoms

3

Solvated electrons

4

Sodium amide

22

What happens in the fractional distillation of crude petroleum?

1

High boiling constituents condense at the top of the column

2

High boiling constituents condense at the bottom of the column

3

The gases condense at the top of the column

4

Petrol condenses at the bottom of the column

23

The atomic weights of two elements X and Y are 14 and 16. They form a series of compounds A, B, C, D and E in which the same amount of element X, Y is present in the ratio 1 : 2 : 3 : 4 : 5. If the compound A has 28 parts by weight of X and 16 parts by weight of Y, then the compound of C will have 28 parts weight of X and \_\_\_\_ parts by weight of Y.

1	80
2	64
3	48
4	32

24

Which of the following set possess the same number of unpaired electrons in their ground state?

1	N, P, V
2	Na, P, Cl
3	$\text{Na}^+$ , $\text{Mg}^{2+}$ , Al
4	$\text{Cl}^-$ , $\text{Fe}^{3+}$ , $\text{Cr}^{3+}$

25

Identify the true statements for the long form of the periodic table.

1	It reflects trends in physical and chemical properties of the elements
2	It reflects the sequence of filling the electrons in the order of sub-energy levels s, p, d and f

3

It helps to predict the stable valency states of the elements

4

All of above

26

Which of the following gas is present at anode and cathode in electrolysis of aqueous copper sulphate with P+ electrodes

1

SO<sub>3</sub> and O<sub>2</sub>

2

O<sub>2</sub> and SO<sub>2</sub>

3

SO<sub>2</sub> and H<sub>2</sub>

4

O<sub>2</sub> and Cu

27

The excess of Na<sup>+</sup> ions in our system

1

causes anaemia

2

causes diabetes

3

causes high B.P.

4

causes low B.P.

28

What are the  $C_v$  values for monoatomic and a diatomic gases?

1

$$\frac{3}{2}R, \frac{3}{2}R$$

2

$$\frac{3}{2}R, \frac{5}{2}R$$

3

$$\frac{5}{2}R, \frac{7}{2}R$$

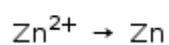
4

$$\frac{1}{2}R, \frac{3}{2}R$$

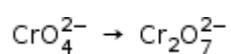
29

The reaction that does not involve either oxidation or reduction is

1



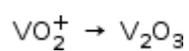
2



3



4



30

Acetals are known as

---

1

diethers

2

ketones

3

aldehyde

4

hydroxy aldehydes

31

\_\_\_\_\_ is phenol.

1

Cresol

2

Benzenol

3

Catechol

4

All of these

32

Which one is most ionic in the given bonds?

1

C - Cl

2

H - Cl

3

Al - Cl

4

Cs – Cl

33

Which of the following is an example for a strong electrolyte?

1

Sodium acetate

2

Sugar

3

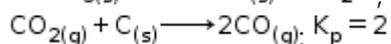
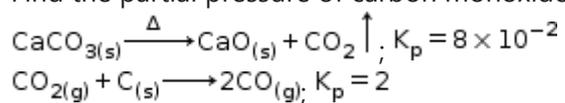
Urea

4

Ammonium hydroxide

34

Find the partial pressure of carbon monoxide from the following



1

4

2

1.6

3

0.4

4

0.2

35

In the group  $\begin{matrix} R' \\ | \\ R \end{matrix} C = O$ , the carbonyl carbon is connected to other atoms by

1

two sigma and one pi bonds

2

three sigma and one pi bonds

3

one sigma and two pi bonds

4

two sigma and two pi bonds

36

On which of the following factor, solubility of a gas in water depends?

1

Pressure of the gas

2

Nature of the gas

3

Temperature

4

All of the above

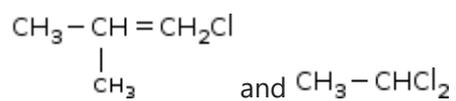
37

Action of hydrogen chloride (HCl) on  $\begin{matrix} CH_3 - C = CH_2 \\ | \\ CH_3 \end{matrix}$  and on  $CH \equiv CH$  will predominantly gives the compounds, respectively

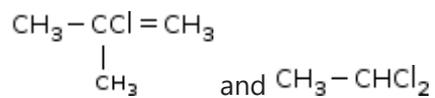
1

$\begin{matrix} CH_3 - CH = CH_3 \\ | \\ CH_3 \end{matrix}$  and  $CH_2Cl - CH_2Cl$

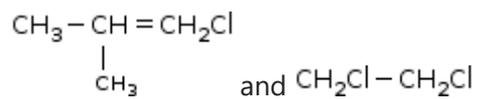
2



3



4



38

What is the mole fraction of benzene in a solution of 7.8 gm benzene  $\text{C}_6\text{H}_6$  and 46.0 gm toluene ( $\text{C}_6\text{H}_5\text{CH}_3$ )?

1

1/2

2

1/3

3

1/5

4

1/6

39

The pairs of species that has same electronic configuration is \_\_\_\_.

1

 $\text{Ti}^{4+}$  and  $\text{V}^{3+}$ 

2

 $\text{Co}^{2+}$  and  $\text{Ni}^{2+}$ 

3

 $\text{Co}^{+3}$  and  $\text{Ni}^{4+}$

4

 $\text{Zn}^{2+}$  and  $\text{Ni}^{2+}$ 

40

Choose the correct option: In Lassaigne's test for N, S and halogens, the organic compound is

1

fused with sodium

2

dissolved with sodamide

3

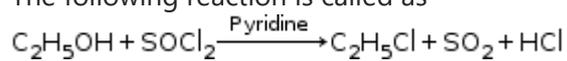
fused with calcium

4

extracted with sodamide

41

The following reaction is called as



1

Darzens procedure

2

Kharasch effect

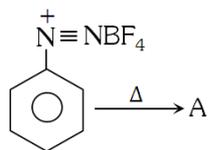
3

Williamson's synthesis

4

Hunsdiecker synthesis reaction

42



In the above process, what is product A?

1

Benzene

2

Fluorobenzene

3

1, 4-difluorobenzene

4

1, 3-difluorobenzene

43

The position of equilibrium can be shifted to the right by \_\_\_ for the reaction  $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5(\text{g})$ .

1

addition of  $\text{Cl}_2$  at constant volume

2

increasing the temperature

3

doubling the volume

4

addition of equimolar quantities of  $\text{PCl}_3$  and  $\text{PCl}_5$ 

44

Which of the following gives an example of non-typical transition elements?

1

Ba, Ca, Sr

2

Zn, Cd, Hg

3

Be, Al, Pb

4

Li, K, Na

45

Nitrobenzene can be made from benzene by using a mixture of conc.  $\text{HNO}_3$  and conc.  $\text{H}_2\text{SO}_4$ . In the nitrating mixture,  $\text{HNO}_3$  acts as

1

catalyst

2

base

3

acid

4

reducing agent

46

In the qualitative analysis of nitrate a brown ring is formed because of the formation of

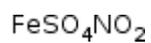
1

 $\text{FeSO}_4 \cdot \text{NO}$ 

2

 $\text{N}_2\text{O} \cdot \text{FeSO}_4$

3



4



47

Which one of the following statements is wrong for ethane?

1

It can be catalytically hydrogenated

2

It can be chlorinated with chlorine

3

When oxidized produces  $\text{CO}_2$  and  $\text{H}_2\text{O}$

4

It is a homologue of iso-butane

48

Substance which is an electrolyte is:

1

Magnesium chloride

2

Toluene

3

Benzene

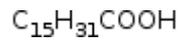
4

Chloroform

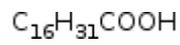
49

Which of the following is palmitic acid?

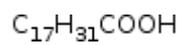
1



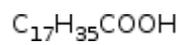
2



3



4



50

\_\_\_\_\_ for the isothermal expansion of an ideal gas.

1

U and H are unaltered

2

H increases but U decreases

3

U increases but H decreases

4

U and H increases

## Botany

1

Anabaena has an immense potential like \_\_\_\_\_

1

food

2

biofertilizer

3

medicines

4

sewage disposal

2

Algae is differentiated from Bryophyta in possessing:

1

Sex organs covered with sterile covering

2

Naked sex organs

3

Aerobic respiration

4

Chlorophylls  $\alpha$  and  $\beta$

3

Which of the following component is involved in the biological oxidation in Krebs' cycle?

1

$\text{CO}_2$

2

$\text{O}_2$

3

$\text{N}_2$

4

SO<sub>2</sub>

4

The division of the plant kingdom into Prokaryota and Eukaryota is based on the characters of \_\_\_\_\_.

1

cell organelles only

2

nucleus only

3

chromosomes only

4

all the above

5

Cyclic photophosphorylation will not take place in the absence of which of the following pigment?

1

Carotenoids

2

Chlorophyll -a

3

Phycoerythrin

4

Xanthophylls

6

\_\_\_\_\_ is an example of alien species invading a new ecosystem resulting in biodiversity losses.

1

Introduction of water hyacinth into India.

2

Introduction of Nile Perch into Lake Victoria in East Africa.

3

Introduction of African catfish into Indian rivers.

4

All of the above.

7

What type of flowers are present in cleistogamous flower?

1

Open female flower

2

Bisexual flowers which remain closed

3

Open male flower

4

Bisexual flowers which remain opened

8

Which is the central, structural atom in the primary photosynthetic pigments?

1

Fe

2

Mg

3

Zn

4

Cu

9

Complete the sentence: Bundle sheath cells

1

lack RuBisCO

2

are rich in PEP carboxylase

3

lack both RuBisCO and PEP carboxylase

4

are rich in RuBisCO

10

Which one of the following tissues do not have specifically thickened walls?

1

Parenchyma

2

Collenchyma

3

Sclereids

4

Fibres

11

DCMU is a herbicide which kills the plant by\_\_\_\_\_.

1

destroying chloroplast

2

checking respiration

3

inhibiting photolysis of water as it is a strong inhibitor of pigment system-I

4

inhibiting carbon dioxide fixation as it is strong inhibitor of pigment system-II

12

In which statement do you consider the best evidence to show that two species of algae are closely related?

1

They both have same type of pigments

2

They both reproduce asexually

3

They both are found in the same habitat

4

They both respire and release CO<sub>2</sub>

13

Find the statements which is not true about somatic embryogenesis.

1

Somatic embryo is induced usually by an auxin such as 2, 4-D.

2

Somatic embryos can develop from microspores.

3

The pattern of development of a somatic embryo is comparable to that of a zygotic embryo.

4

A somatic embryo develops from a somatic cell.

14

Sweet potato is modification of \_\_\_\_\_.

1

flowering axis

2

root

3

stem

4

leaf

15

Grass stem elongates by the activity of \_\_\_\_\_.

1

primary meristem

2

apical meristem

3

intercalary meristem

4

secondary meristem

16

By which of the following component, the viability of seeds is tested?

1

2, 6 dichlorophenol indophenols

2

2, 3, 5 triphenyl tetrazolium chloride

3

Safranine

4

DMSO

17

\_\_\_\_\_ organisms breeds only once in lifetime.

1

Oysters

2

Bamboo

3

Birds

4

Pelagic fishes

18

What type of gametes will make by genotype RrYy?

1

Rr, RR, Yy, YY

2

RY, Ry, rY, ry

3

RY, Ry, ry, ry

4

Ry, Ry, Yy, ry

19

Select the function of germ pore.

1

Initiation of pollen tube

2

Absorption of water for seed germination

3

Release of male gametes

4

Emergence of radical

20

In oogamy, fertilization contains \_\_\_\_\_.

1

a large non-motile female gamete and a small motile male gamete

2

a small non-motile female gamete and a large motile male gamete

3

a large motile female gamete and a small non-motile male gamete

4

a large non-motile female gamete and a small non-motile male gamete

21

T. Schwann and M. Schleiden were \_\_\_\_\_.

1

Austrian biologists

2

German biologists

3

English biologists

4

Dutch biologists

22

\_\_\_\_\_ process will be most adversely affected if microorganisms are removed from a forest ecosystem.

1

Carbon assimilation and nitrogen fixation

2

Decomposition of organic matter and photosynthesis

3

Nitrogen fixation and decomposition of organic matter

4

Solar energy fixation and nutrient cycling

23

Which of the following products are obtained when yeast ferments glucose?

1

Water and CO<sub>2</sub>

2

Ethanol and water

3

Ethanol and CO<sub>2</sub>

4

Methanol and CO<sub>2</sub>

24

The presence of \_\_\_\_\_ make the long plants capable for standing erect.

1

sclerenchyma

2

collenchyma

3

prosenchyma.

4

parenchyma

25

Mark the incorrect condition regarding dicot root.

1

Inconspicuous pith

2

Polyarch condition

3

Presence of conjunctive parenchyma

4

2 to 4 xylem and phloem patches

26

What was the duration of Mendel's hybridization experiments on garden peas plant?

1

4 years

2

5 years

3

6 years

4

7 years

27

In which of the following process pneumatophores are useful?

1

Transpiration

2

Respiration

3

Protein synthesis

4

Guttation

28

\_\_\_\_\_ are animals that live in deep oceanic waters.

1

Secondary consumers

2

Detritivores

3

Primary consumers

4

Tertiary consumers

29

If a cross between two individuals produces off springs with 50% dominant character (A) and 50% recessive character (a), find the genotype of parents.

1

 $Aa \times Aa$ 

2

 $Aa \times aa$ 

3

 $AA \times Aa$ 

4

 $AA \times aa$

30

Keystone species deserve protection as

1

these indicate presence of certain minerals in the soil

2

these are capable of surviving in harsh environmental conditions

3

these have become rare due to overexploitation

4

these play an important role in supporting other species.

31

By \_\_\_\_\_, water is absorbed.

1

root hairs

2

root cap

3

root apex

4

root

32

Find the correct sequence of events during mitosis.

1

Condensation → Nuclear membrane disassembly → Arrangement at equator  
→ Centromere division → Segregation → Telophase

2

Condensation → Crossing over → Nuclear membrane disassembly → Segregation → Telophase

3

Condensation → Nuclear membrane disassembly → crossing over → Segregation → Telophase

4

Condensation → Arrangement at equator → Centromere division → Segregation → Telophase

33

Kingdom protista has \_\_\_\_.

1

Amoeba, Euglena, Escherichia

2

Amoeba, Euglena, Chlamydomonas

3

Amoeba, Euglena, Pseudomonas

4

Amoeba, Euglena, Penicillium

34

How do offsprings resemble parents, in sexual reproduction?

1

Functionally but not structurally

2

Structurally but not functionally

3

Both structurally and functionally

4

Neither structurally nor functionally

35

Bolting may be induced by \_\_\_\_ phytohormone.

1

ABA

2

gibberellin

3

auxin

4

cytokinin

36

Oxidative decarboxylation of pyruvic acid results in the formation of which of the following compound?

I. Acetyl CoA II.  $\text{CO}_2$  III. ATP IV.  $\text{NADH} + \text{H}^+$

1

I only

2

I, II and III only

3

I and II only

4

I, II and IV only

37

During cell growth, DNA synthesis takes place in which one of the following phase?

1

S- phase

2

M phase

3

$G_2$ -phase

4

$G_1$ -phase

38

By which chemical the viability of seeds is tested?

1

2, 6 dichlorophenol indophenols

2

2, 3, 5 triphenyl tetrazolium chloride

3

safranine

4

DMSO

39

Senescence as an active development cellular process in the growth and functioning of a flowering plant, is indicated in which of the following?

1	Leaf abscission
2	Floral parts
3	Vessels and tracheid differentiation
4	Annual plants

40

In an organism that has 44 chromosomes i.e. 22 homologous pairs; at the end of first meiotic division the daughter cell will have \_\_\_ chromosomes.

1	44
2	22
3	11
4	Any number between 44 and 22

41

When man eats fish which feeds on zooplanktons which have eaten small plants, identify is the producer in this chain?

1	Fish
2	Small plants

3

Man

4

Zooplankton

42

Where are the intercalary meristems are present?

1

In the nodal region

2

In the internodal region

3

In the bryophytes

4

In the nodal region close to base of plant

43

Who discovered the 'law of limiting factor' as the 'law of minimum'?

1

Hill

2

Blackman

3

Leibig

4

Priestley

44

One of the twelve megadiversity countries is India with how much percentage of genetic resources of the world?

1

18.1%

2

12.1%

3

38.1%

4

8.1%

45

To produce 1024 cells by vegetative reproduction, how many generations are required for a bacterium?

1

6

2

8

3

10

4

256

46

In \_\_\_\_\_ of mitosis the chromosomes are arranged around the equator of the spindle.

1

metaphase

2

prophase

3

anaphase

4

telophase

47

\_\_\_\_\_ can photosynthesis its food.

1

Euglena

2

Monocystis

3

Paramecium

4

Hydra

48

Crick, one of the discoverer of DNA double helical structure, was the man of which subject?

1

Physics

2

Chemistry

3

Botany

4

Zoology

49

Choose the correct option: During somatic hybridization in plants

1

the cell walls and the middle lamella are digested before fusing the cells

2

the apical meristems are cultured to get virus-free plants.

3

crop plants with higher levels of vitamins, proteins and minerals are hybridized

4

somaclones are produced in large numbers

50

In \_\_\_\_\_ cycles,  $O_2$  is directly used.

1

Oxidative decarboxylation

2

Fermentation

3

Electron transport chain

4

Glycolysis

# Zoology

1

What is the function of somatostatin?

1

To inhibit the release of gonadotropins from pituitary

2

To stimulates pituitary synthesis and release gonadotropins

3

To stimulate pituitary and promotes the secretion of growth hormone

4

To inhibit the release of growth hormone from the pituitary

2

At ends of nerve fibres, which of the following is secreted?

1

Acetic acid

2

Acetylcholine

3

Acetyl CoA

4

Ascorbic acid

3

Colour blindness is because of defect in

---

1

cones

2

rods and cones

3

rods

4

rhodopsin

4

A man takes large amount of protein. He is likely to secrete more amount of

1

Glucose

2

Water

3

Salts

4

Urea and uric acid

5

**Statement 1:** Migration of individuals into a country is emigration.

**Statement 2:** Migration of individuals out of the country is immigration.

1

Both Statement 1 and Statement 2 are true but Statement 2 is not the correct explanation of Statement 1

2

Both Statement 1 and Statement 2 are true and the Statement 2 is correct explanation of the Statement 1

3

This Statement 1 is true but the Statement 2 is false

4

Both statements are false

6

The events not associated with ovulation in human female is

1

LH surge

2

release of secondary oocyte

3

decrease in estradiol

4

full development of Graafian follicle

7

Vitellogenesis occurs during the \_\_\_\_\_ formation.

1

oogonial cell in the Graafian follicle

2

secondary oocyte in the Fallopian tube

3

primary oocyte in the Graafian follicle

4

ootid in the Fallopian tube

8

One reason that pathogenic microorganisms have an advantage in the host they infect is because they:

1

have previously been encountered through natural exposure

2

have previously been encountered through vaccination

3

strengthen the host's immune response

4

reproduce and evolve more rapidly than the host can eliminate them

9

Chromosomal abnormality of an unborn baby (while in mother's womb) can be found out by a technique termed as \_\_\_\_.

1

CAT scanning

2

amniocentesis

3

ultrasound

4

tissue culture

10

Choose a most primitive mode of nutrition exists along the life.

1

Chemo- autotrophic

2

Chemo €" heterotrophic

3

Areobic €" phototrophic

4

Anaerobic phototrophic

11

Increase in blood pressure is because of

1

hypertension

2

hypotension

3

hyperglycemia

4

hypochromia

12

Charles Darwin returned to England in 1836 from his five years expedition but published his observations and conclusions in November \_\_\_\_, in the form of a book.

1

1839

2

1838

3

1859

4

1861

13

Which blood group can be transmitted to patients of any blood group?

1

AB

2

B

3

A

4

O

14

What is an inter-vertebral disc?

1

Body of vertebrae

2

Cartilage bone in the body

3

Pad in the centrum of bone

4

Fibro cartilage between the centrum of vertebrae

15

What is the purpose of polymerase chain reaction?

1

DNA modification

2

DNA amplification

3

DNA visualization

4

DNA replication

16

'Bundle of His' is a part of \_\_\_\_\_ organs in humans.

1

brain

2

heart

3

kidney

4

pancreas

17

Partial pressure of oxygen and carbon dioxide in healthy human lung alveoli are \_\_\_\_\_.

1

104 and 40 mm Hg

2

90 and 20 mm Hg

3

159 and 0.3 mm Hg

4

40 and 45 mm Hg

18

Which statement in regard to nerve activity is true?

1

In tetanus the excitatory impulse to muscles are inhibited leading to lock jaw

2

Information across the synaptic cleft is transmitted by means of a chemical neurotransmitter in small vesicle

3

The synaptic cleft does not prevent direct propagation of action potential from presynaptic neuron to post synaptic cell

4

Combination of neurotransmitter with receptor site changes membrane potential without changing membrane potentiality

19

\_\_\_\_\_ pituitary hormones is secreted without the involvement of a releasing hormone (RH).

1

Follicle Stimulating Hormone (FSH)

2

Thyroid Stimulating Hormone (TSH)

3

Oxytocin

4

Prolactin

20

The removal of 'keystone' species will affect which of the following component?

1

The consumers

2

The producers

3

The ecosystem

4

The decomposers

21

Find the correct statement from the following.

1

Hormone produced in small intestine stimulates heart

2

Hormone produced in thyroid stimulates metabolism

3

Hormone produced in ovary affects the uterine contraction

4

Hormone produced in adrenal cortex stimulates heart beat

22

What is the use of technique PCR and restriction fragment length polymorphism?

1

Genetic transformation

2

To study of enzymes

3

DNA sequencing

4

Genetic fingerprinting

23

\_\_\_\_\_ is responsible for the production of progesterone, (the hormone responsible for the maintenance of endometrium).

1

Uterus

2

Graafian follicle

3

Ovary

4

Corpus luteum

24

Fill the blanks using correct option:

\_\_(i)\_\_ methods work on the principle of avoiding chances of ovum and sperms meeting.

\_\_(ii)\_\_ is one such method in which the couples avoid or abstain from coitus from day 10 to 17 of the menstrual cycle.

\_\_(iii)\_\_ is another method in which the male partner withdraws his penis from the vagina just before ejaculation so as to avoid insemination.

\_\_(iv)\_\_ method is based on the fact that ovulation and therefore the cycle do not occur during the period of intense lactation following parturition.

1

(i)	(ii)	(iii)	(iv)
Surgical	Periodic abstinence	Coitus Interruptus	Lactational amenorrhea

2

(i)	(ii)	(iii)	(iv)
Natural	Periodic abstinence	Coitus Interruptus	Lactational amenorrhea

3

(i)	(ii)	(iii)	(iv)
IUDs	Lactational amenorrhea	Coitus Interruptus	Periodic abstinence

4

(i)	(ii)	(iii)	(iv)
Barrier	Coitus Interruptus	Periodic abstinence	Lactational amenorrhea

25

Erythropoiesis may be stimulated by the insufficiency of

1

Protein

2

Oxygen

3

Iron

4

None of the above

Sugar and amino acids are \_\_\_\_\_.

1	secondary metabolites
2	primary metabolites
3	feed stock
4	inoculum

Match the excretory organs listed under column I with the animals given under column II. Choose the answer which gives the correct combination of alphabets of the two columns.

Column I (Excretory organs)	Column II (Animals)
A. Nephridia	p. Hydra
B. Malpighian tubules	q. Leech
C. Protonephridia	r. Shark
D. Kidneys	s. Round worms
	t. Cockroach

1	A = q; B = t; C = s; D = r
2	A = s; B = q; C = p; D = t
3	A = q; B = s; C = t; D = p
4	A = t; B = q; C = s; D = r

28

The ankle and elbow joints are \_\_\_\_ joints.

1

gliding and hinge

2

hinge and pivot

3

ellipsoid and condyloid

4

pivot and hinge

29

Some statements are given below. Determine the true or false statements by marking them (T) or (F) respectively.

- i) Tubectomy and vasectomy have many side effects
- ii) Preventing egg formation is the purpose of tubectomy
- iii) Contraceptive oral pills help in birth control by preventing ovulation
- iv) Genital warts is a sexually transmitted disease cause by herpes virus
- v) There is rapid decline in infant mortality rate and MMR, in India

1

(i)	(ii)	(iii)	(iv)	(v)
T	T	T	F	F

2

(i)	(ii)	(iii)	(iv)	(v)
F	F	T	F	T

3

(i)	(ii)	(iii)	(iv)	(v)
T	F	T	F	F

4

(i)	(ii)	(iii)	(iv)	(v)
F	F	F	T	T

30

Proximal convoluted tubule of nephron is responsible for which of the following event?

1

Maintenance of glomerular filtration rate

2

Filtration of blood

3

Selective reabsorption of glucose, amino acid, NaCl and water

4

Reabsorption of salts only

31

\_\_\_\_\_ is the main ion involved in nerve impulse transmission.

1

$\text{Ca}^{2+}$

2

$\text{Na}^+$

3

$\text{K}^+$

4

$\text{Mg}^{2+}$

32

Column I	Column II
Animals with common name	Animals with zoological name
A Starfish	p. <i>Sepia</i>
B Jellyfish	q. <i>Astropeden</i>
C Devilfish	r. <i>Aurelia</i>
D Cuttlefish	s. <i>Mobula</i>

1

A- r, B- s, C- p, D- q

2

A- r, B- p, C- s, D- q

3

A- q, B- r, C- s, D- p

4

A- q, B- p, C- s, D- r

33

Match the following

Column (A)	Column (B)
A. Pore bearing animals	1. Arthropoda
B. Diploblastic	2. Coelenterata
C. Metameric segmentation	3. Porifera
D. Joined legs	4. Echinodermata
E. Soft bodied animals	5. Mollusca
F. Spiny skinned animals	6. Annelida

1

A-3, B-2, C-6, D-1, E-5, F-4

2

A-2, B-3, C-6, D-1, E-5, F-4

3

A-3, B-6, C-2, D-1, E-5, F-4

4

A-3, B-2, C-1, D-6, E-5, F-4

34

Which one of the following correctly explains the function of a specific part of the human nephron?

1

Podocytes : create minute spaces (slit pores) for the filtration of blood into the Bowman's capsule

2

Henle's loop : most reabsorption of the major substances from the glomerular filtrate

3

Afferent arteriole : carries the blood away from the glomerulus towards renal vein

4

Distal convoluted tubule : reabsorption of  $K^+$  ions into the surrounding blood capillaries

35

When domestic sewage mixes with river water, what will happen?

1

The increased microbial activity releases micronutrients such as iron

2

Small animals like rats will die after drinking river water

3

The increased microbial activity uses up dissolved oxygen

4

The river water is still suitable for drinking as impurities are only about 0.1%

36

Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled as

1

pressure in the lungs is higher than the atmospheric pressure

2

there is a negative intrapleural pressure pulling at the lungs walls

3

there is a positive intrapleural pressure

4

there is a negative pressure in the lungs

37

In humans the oocyte is maintained in a state of meiotic arrest by \_\_\_\_\_ secretions.

1

granulose cells

2

zona pellucida

3

theca

4

cumulus oophorus

38

Where are the vocal cords situated?

1

At glottis

2

At pharynx

3

At larynx

4

At bronchial tube

39

\_\_\_\_\_ is not a synovial joint.

1

Hinge joint

2

Pivot joint

3

Sutures forming the cranium

4

Ball and socket joint

40

Mark the correct statement about the hormone action in humans.

1

Secretion of thymosins is stimulated with aging.

2

Glucagon is secreted by  $\beta$ -cells of islets of Langergans and stimulates glycogenolysis.

3

In females, FSH first binds with specific receptors on ovarian cell membrane.

4

FSH stimulates the secretion of estrogen and progesterone.

41

In \_\_\_ carbonic anhydrase is present.

1

blood plasma

2

RBC

3

platelets

4

WBC

42

Lactic acid bacteria (LAB) grow in milk and convert it to curd, by increasing \_\_\_\_ it improve its nutritional quality.

1

vitamin C and A

2

vitamin  $B_{12}$

3

vitamin B<sub>6</sub>

4

vitamin A

43

Which of the following produces plasma and Memory cells?

1

Phagocytes

2

T-lymphocytes

3

B-lymphocytes

4

D-lymphocytes

44

If for some reason, the vasa efferentia in the human reproductive system get blocked, the gametes will not be transported from which organ?

1

Testes to epididymis

2

Ovary to uterus

3

Epididymis to vas deferens

4

Vagina to uterus

45

A complex polysaccharide developed from sucrose by the bacterium *Leuconostoc mesenteroides* is :

1

Dextran

2

Cellulose

3

Starch

4

Chitin

46

On which membrane receptor sites for neurotransmitters are present?

1

Tips of axons

2

Pre-synaptic membrane

3

Post- synaptic membrane

4

Membranes of synaptic vesicles

47

With the help of \_\_\_\_, cockroach searches its food.

1

walking legs

2

mandibles

3

eye

4

antennae

48

Where the principal nitrogenous excretory compound in humans is synthesised?

1

In liver and also eliminated by the same through bile

2

In kidneys but eliminated mostly through liver

3

In kidneys as well as eliminated by kidneys

4

In the liver, but eliminated mostly through kidneys

49

\_\_\_\_\_ fatty acids is liquid at room temperature.

1

Palmitic acid

2

Stearic acid

3

Linoleic acid

4

Oleic acid

50

\_\_\_\_\_ is not a second messenger in hormone action.

1

Calcium

2

Sodium

3

cGMP

4

cAMP

## Physics - Answer keys

1

4

2

2

3

1

4

2

5

2

6

4

7

3

8

1

9

1

10

2

11

2

12	3
13	3
14	4
15	3
16	4
17	2
18	3
19	3
20	2
21	2
22	4
23	2
24	3
25	3
26	2
27	4
28	4
29	4
30	2
31	2
32	2
33	3
34	3
35	4
36	4
37	1

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38	3
39	2
40	1
41	4
42	1
43	2
44	3
45	4
46	1
47	3
48	3
49	4
50	1

## Chemistry - Answer keys

1	3
2	3
3	3
4	1
5	1
6	4
7	1
8	2
9	4
10	4
11	2
12	2

13	3
14	1
15	3
16	2
17	1
18	1
19	3
20	4
21	3
22	2
23	3
24	1
25	4
26	4
27	3
28	2
29	2
30	1
31	4
32	4
33	1
34	3
35	2
36	4
37	3
38	4

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39	3
40	1
41	1
42	2
43	1
44	2
45	3
46	1
47	1
48	1
49	1
50	1

## Botany - Answer keys

1	2
2	2
3	2
4	4
5	2
6	4
7	2
8	2
9	4
10	1
11	4
12	1
13	2

14	2
15	3
16	2
17	2
18	2
19	1
20	1
21	2
22	3
23	3
24	1
25	2
26	4
27	2
28	2
29	2
30	4
31	1
32	1
33	2
34	1
35	2
36	4
37	1
38	2
39	3

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40	2
41	2
42	1
43	3
44	4
45	3
46	1
47	1
48	1
49	1
50	3

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## Zoology - Answer keys

1	4
2	2
3	1
4	4
5	4
6	3
7	3
8	4
9	2
10	2
11	1
12	3
13	4
14	4

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15	2
16	2
17	1
18	2
19	3
20	3
21	2
22	4
23	4
24	2
25	2
26	2
27	1
28	1
29	2
30	3
31	1
32	3
33	3
34	1
35	3
36	2
37	1
38	3
39	3
40	3

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- 41 2
- 42 2
- 43 3
- 44 1
- 45 4
- 46 3
- 47 4
- 48 4
- 49 1
- 50 2

## Physics - Solutions

1

$$\text{As, } g' = g - \omega^2 R \cos^2 \lambda$$

Thus, for weightlessness at equator  $\lambda = 0^\circ$  and  $g' = 0$ .

$$\therefore 0 = g - \omega^2 R \Rightarrow \omega = \sqrt{\frac{g}{R}} = \frac{1}{800} \frac{\text{rad}}{\text{s}}$$

2

A lake cools from the surface down. Above  $4^\circ\text{C}$ , the cooled water at the surface flows to the bottom due to its greater density. But when the surface temperature drops below  $4^\circ\text{C}$  (here it is  $2^\circ\text{C}$ ), the water near the surface is less denser than the warmer water below. Therefore the downward flow ceases, the water at the bottom remains at  $4^\circ\text{C}$  until nearly the entire lake, is frozen.

3

Given,  $V_L = 46$  volt,  $V_C = 40$  volt,  $V_R = 8$  volt

Thus, the e.m.f. of source is given by,

$$V = \sqrt{8^2 + (46 - 40)^2} = 10 \text{ volt}$$

4

In this case,  $\frac{Q}{t} = \frac{KA \Delta\theta}{l} = \frac{\Delta\theta}{(l/KA)} = \frac{\Delta\theta}{R}$  ( $R = \text{Thermal resistance}$ )

$\Rightarrow t \propto R$  (As  $Q$  and  $\Delta\theta$  are same)

$$\frac{t_P}{t_S} = \frac{R_P}{R_S} = \frac{R/2}{2R} = \frac{1}{4}$$

$$\therefore t_S = \frac{t_P}{1/4} = \frac{4}{4} = 1 \text{ min.}$$

(Since series resistance  $R_S = R_1 + R_2$  and parallel resistance  $R_P = \frac{R_1 R_2}{R_1 + R_2}$ )

5

Time to cross the river.

$$t = \frac{\text{width of river}}{\text{speed of man}} = \frac{1 \text{ km}}{4 \text{ km h}^{-1}} = \frac{1}{4} \text{ h} = 15 \text{ min}$$

6

Here,  $m_1 = 3 \text{ kg}$ ,  $m_2 = 5 \text{ kg}$ ,  $u_1 = u_2 = 0$ ,  $v_1 = v_2 = v$

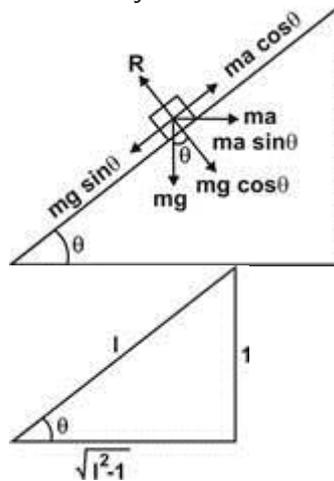
Since  $F_1 = F_2$  [Same force is acting on the bodies]

$$\therefore m_1 \left( \frac{v_1 - u_1}{t_1} \right) = m_2 \left( \frac{v_2 - u_2}{t_2} \right) \text{ or } 3 \frac{(v - 0)}{t_1} = 5 \frac{(v - 0)}{t_2}$$

$$\text{or } \frac{3v}{t_1} = \frac{5v}{t_2} \text{ or } \frac{t_1}{t_2} = \frac{3v}{5v} = \frac{3}{5}$$

7

For the object to remain stationary relative to the incline, figure clearly shows that



$$ma \cos \theta = mg \sin \theta \text{ or } a = g \tan \theta$$

$$\text{Since } \sin \theta = \frac{1}{l} \Rightarrow \tan \theta = \frac{1}{\sqrt{l^2 - 1}}$$

$$\therefore a = \frac{g}{\sqrt{l^2 - 1}}$$

8

Centre of mass is a point where the whole mass of the body is supposed to be concentrated

9

$$R \propto \frac{l^2}{m} \Rightarrow R_1 : R_2 : R_3 = \left( \frac{l_1}{m_1} \right)^2 : \left( \frac{l_2}{m_2} \right)^2 : \left( \frac{l_3}{m_3} \right)^2$$

$$= \frac{25}{1} : \frac{9}{3} : \frac{1}{5} = 25 : 3 : \frac{1}{5} \Rightarrow 125 : 15 : 1$$

10

$$F = f_s = \mu_s mg \quad \dots (i)$$

When the body starts moving with acceleration  $a$ , then,  $F - f_k = ma$

$$\text{or } \mu_s mg - \mu_k mg = ma \quad (\text{Using (i)})$$

$$\text{or } a = (\mu_s - \mu_k)g = (0.5 - 0.4) \times 10 = 0.1 \times 10 \text{ m s}^{-2} = 1 \text{ m s}^{-2}$$

11

If the body is projected vertically upward then at the highest point its velocity is zero but acceleration is not equal to zero. ( $g = 9.8 \text{ m/s}^2$ )

12

$$\text{Here, } T = 2\pi\sqrt{\frac{l}{g}}$$

$$\Rightarrow \frac{T'}{T} = \sqrt{\frac{g}{g'}} = \sqrt{\frac{g}{g + \frac{g}{4}}} = \sqrt{\frac{4}{5}} = \frac{2}{\sqrt{5}}$$

13

$$\text{As we know, } PV = \mu RT = \frac{m}{M}RT$$

$$\Rightarrow \frac{m}{VP} \Rightarrow \frac{\text{density}}{P} = \frac{M}{RT}$$

$$\left(\frac{\text{density}}{P}\right)_{\text{At } 0^\circ\text{C}} = \frac{M}{R(273)} = x \quad \dots(i)$$

$$\left(\frac{\text{density}}{P}\right)_{\text{At } 100^\circ\text{C}} = \frac{M}{R(373)} \quad \dots(ii)$$

$$\Rightarrow \left(\frac{\text{density}}{P}\right)_{\text{At } 100^\circ\text{C}} = \frac{273}{373}x$$

14

$$g_h = \frac{gR^2}{(R+h)^2}$$

Acceleration due to gravity at a height  $h$  from the surface of the earth is where  $g$  is the acceleration due to gravity on the surface of the earth and  $R$  is the radius of the earth.

$$g_h = g \frac{(6400)^2}{(6400+100)^2} = g \left(\frac{6400}{6500}\right)^2 \quad \dots(i)$$

So, % change in acceleration due to gravity

$$= \frac{g - g_h}{g} \times 100\% = \left(1 - \frac{g_h}{g}\right) \times 100\%$$

$$= \left(1 - \left(\frac{6400}{6500}\right)^2\right) \times 100\% \quad (\text{Using (i)}) = 3\%$$

15

Here, the length is the circumference of the ring. Therefore,

Initial length of the ring =  $2\pi r$

Final length of the ring =  $2\pi R$

Change in length =  $2\pi R - 2\pi r$

$$\therefore \text{Strain} = \frac{\text{change in length}}{\text{original length}}$$

$$\Rightarrow \frac{2\pi(R-r)}{2\pi r} = \frac{R-r}{r}$$

Now Young's modulus,  $E = \frac{F/A}{l/L} = \frac{F/A}{(R-r)/r}$

$$\therefore F = AE \left(\frac{R-r}{r}\right)$$

16

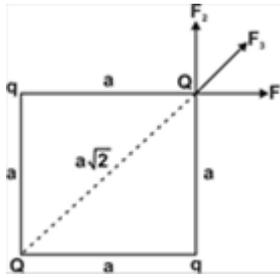
$$\text{We know, } V \propto T \Rightarrow \frac{V_2}{V_1} = \frac{T_2}{T_1}$$

$$\Rightarrow \frac{V_2 - V_1}{V_1} = \frac{T_2 - T_1}{T_1}$$

$$\Rightarrow \frac{\Delta V}{V} = \frac{(273+40) - (273+20)}{(273+20)}$$

$$\Rightarrow \frac{(313-293)}{293} = 0.07$$

17



Let  $a$  be side of a square.

$$F_1 = F_2 = \frac{Qq}{4\pi\epsilon_0 a^2}$$

$$F_3 = \frac{QQ}{4\pi\epsilon_0 (a\sqrt{2})^2} = \frac{Q^2}{4\pi\epsilon_0 (a\sqrt{2})^2}$$

As the resultant force on  $Q$  is zero, so  $F_3 \cos 45^\circ = -F_1$

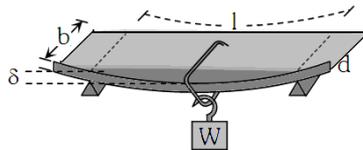
$$\Rightarrow \frac{Q^2}{4\pi\epsilon_0 (a\sqrt{2})^2} \frac{1}{\sqrt{2}} = -\frac{Qq}{4\pi\epsilon_0 a^2} \Rightarrow Q = -2\sqrt{2}q$$

18

Given that, velocity is same. Therefore by using  $v = a\omega$ , we get

$$\Rightarrow A_1\omega_1 = A_2\omega_2 = A_3\omega_3$$

19



Here, depression in beam is given by,

$$\delta = \frac{WL^3}{4Ybd^3}, \therefore \delta \propto \frac{1}{Y}$$

20

The earth binds the atmosphere due to gravity.

21

The work done,

$$W = T \times 8\pi(r_2^2 - r_1^2) = T \times 8\pi \left( \frac{D^2}{4} - \frac{d^2}{4} \right) \\ \Rightarrow 2\pi(D^2 - d^2)T$$

22

Here,  $m_1\vec{r}_1 + m_2\vec{r}_2 = 0$

$$\Rightarrow \frac{m}{4} 15\hat{j} + \frac{3m}{4} \vec{r}_2 = 0 \Rightarrow \vec{r}_2 = -5\hat{j}$$

It means larger fragment is at  $y = -5$  cm.

23

$$\frac{W \sin \alpha}{\cos(\theta - \alpha)}$$

24

We know, bulk modulus,  $B = -V_0 \frac{\Delta p}{\Delta V} \Rightarrow \Delta V = -V_0 \frac{\Delta p}{B}$

$$\Rightarrow V = V_0 \left[ 1 - \frac{\Delta p}{B} \right]$$

$$\therefore \text{Density, } \rho = \rho_0 \left[ 1 - \frac{\Delta p}{B} \right]^{-1} = \rho_0 \left[ 1 + \frac{\Delta p}{B} \right]$$

where,  $\Delta p = p - p_0 = h\rho_0 g$

= pressure difference between depth and surface of ocean

$$\therefore p = p_0 \left[ 1 + \frac{\rho_0 g y}{B} \right] (\because h = y)$$

25

Consider  $\vec{E}$  be the electric field intensity at a point on the circumference of the ring. Then,

the emf induced  $\varepsilon = \oint \vec{E} \cdot d\vec{l}$  where  $d\vec{l}$  is a length element of the ring. Since  $\left| \frac{d\vec{B}}{dt} \right|$  is constant and  $\vec{E} \parallel d\vec{l}$ ,

$$\therefore \varepsilon = E(2\pi r) \dots (i)$$

Also, the induced emf is  $\varepsilon = \frac{d\phi}{dt} = \pi r^2 \frac{dB}{dt} = \pi r^2 x \dots (ii)$

By equating (i) and (ii), we obtained  $E = \frac{rx}{2}$

26

We know,  $a = \omega^2 r = 4\pi^2 n^2 r = 4\pi^2 \times 1^2 \times 20 \times 10^3$

$$\therefore a = 8 \times 10^5 \text{ m/s}^2$$

27

$$v^2/r$$

28

Water levels in both sections A and B go up.

29

Given,  $l = 50 \text{ cm} = 50 \times 10^{-2} \text{ m}$ ,  $A = 1 \text{ mm}^2 = 1 \times 10^{-6} \text{ m}^2$ ,  $V = 2 \text{ V}$ ,  $I = 4 \text{ A}$

According to Ohm's law,  $V = IR$

$$\text{or } R = \frac{V}{I} = \frac{2}{4} = \frac{1}{2} \Omega \dots (i)$$

Resistance of a wire is  $R = \rho \frac{l}{A}$  (Using (i))

$$\therefore \rho = \frac{A}{l} R = \frac{10^{-6}}{2 \times 50 \times 10^{-2}} = 10^{-6} \Omega \text{ m}$$

30

The change in internal energy is always equal to the heat supplied at constant volume.

$$\Rightarrow \Delta U = (\Delta Q)_V = \mu C_V \Delta T$$

For mono-atomic gas,  $C_V = \frac{3}{2} R$

$$\Rightarrow \Delta U = \mu \left( \frac{3}{2} R \right) \Delta T = 1 \times \frac{3}{2} \times 8.31 \times (100 - 0) = 12.48 \times 10^2 \text{ J}$$

31

Here, the coefficient of apparent expansion is,

$$Y_{\text{app}} = \frac{\text{Mass expelled}}{\text{Mass remained} \times \Delta T} = \frac{x/100}{x \times 80} = \frac{1}{8000} = 1.25 \times 10^{-4} / ^\circ\text{C}$$

32

Here,  $r = \frac{p}{qB} \Rightarrow p \propto q$  (As  $r$  and  $B$  are constant)

$$\frac{p_p}{q_p} = \frac{q_p}{2q_p} = \frac{1}{2}$$

$$\Rightarrow p_\alpha = \frac{q_\alpha}{2}$$

33

$$\text{Distance average speed} = \frac{2v_1v_2}{v_1+v_2} = \frac{2 \times 20 \times 30}{20+30}$$

$$\Rightarrow \frac{120}{5} = 24 \text{ km/hr}$$

34

The force of friction between the block and the belt is  $f = \mu mg$  where  $m$  is the mass of the object. This force produces an acceleration of the block which is given by

$$a = \frac{\text{force}}{\text{mass}} = \frac{\mu mg}{m} = \mu g$$

The block will slide on the belt without slipping until its speed ( $v$ ) becomes equal to the speed of the belt. As  $u=0$ , we have  $v^2 = 2as$

$$\text{or } s = \frac{v^2}{2a} = \frac{v^2}{2\mu g} = \frac{(5)^2}{2 \times 0.5 \times 10} = 2.5 \text{ m}$$

35

We know,  $F \propto Q_1Q_2$

$$\frac{F_1}{F_2} = \frac{Q_1Q_2}{Q_1'Q_2'} = \frac{10 \times -20}{-5 \times -5} = -\frac{8}{1}$$

36

We know,

$$t = \sqrt{\frac{2h}{g+a}} = \sqrt{\frac{2 \times 2.7}{(9.8+1.2)}} = \sqrt{\frac{5.4}{11}} = \sqrt{0.49} = 0.7 \text{ s}$$

As  $u=0$  and lift is moving upward with acceleration.

37

Pressure

38

Here, pressure at half the depth  $= P_0 + \frac{h}{2} dg$   
and Pressure at the bottom  $= P_0 + hdg$

$\therefore$  According to given condition,

$$P_0 + \frac{h}{2} dg = \frac{2}{3} (P_0 + hdg)$$

$$\Rightarrow 3P_0 + \frac{3h}{2} dg = 2P_0 + 2hdg$$

$$\Rightarrow h = \frac{2P_0}{dg} = \frac{2 \times 10^5}{10^3 \times 10} = 20 \text{ m}$$

39

According to first law of thermodynamics,

$$\text{For the path } iaf, Q_{iaf} = \Delta U_{iaf} + W_{iaf}$$

$$\text{Or } \Delta U_{iaf} = Q_{iaf} - W_{iaf} = 50 - 20 = 30 \text{ cal}$$

$$\text{For the path } ibf, Q_{ibf} = \Delta U_{ibf} + W_{ibf}$$

As change in internal energy is path independent, so  $\Delta U_{iaf} = \Delta U_{ibf}$

$$\therefore Q_{ibf} = \Delta U_{iaf} + W_{ibf} \text{ or } W_{ibf} = Q_{ibf} - \Delta U_{iaf} = 36 - 30 = 6 \text{ cal}$$

40

For a simple harmonic motion, acceleration,  $a = -\omega^2 x$  where  $\omega = \frac{2\pi}{T}$  is a constant.

$$\therefore a = -\frac{4\pi^2}{T^2} x \text{ or } \frac{aT}{x} = -\frac{4\pi^2}{T}$$

The period of oscillation  $T$  is a constant.

$\therefore \frac{aT}{x}$  is a constant.

41

As we know velocity,  $v = \frac{dx}{dt} = 3 - 8t + 3t^2$

$$\therefore v_0 = 3 \text{ m/s and } v_4 = 19 \text{ m/s}$$

According to work energy theorem,

$$W = \frac{1}{2} m (v_4^2 - v_0^2)$$

$$\Rightarrow \frac{1}{2} \times 0.03 \times (19^2 - 3^2) = 5.28 \text{ J}$$

42

As, Work done on the body = K.E. gained by the body

$$\therefore F S \cos \theta = 1 \text{ Joule}$$

$$\Rightarrow F \cos \theta = \frac{1}{s} = \frac{1}{0.4} = 2.5 \text{ N}$$

43

As the body is released from the position  $p$  (inclined at angle  $\theta$  from vertical), then velocity at mean position,  $v = \sqrt{2gl(1 - \cos \theta)}$ .

$$\text{Thus, tension at the lowest point} = mg + \frac{mv^2}{l}$$

$$\Rightarrow mg + \frac{m}{l} [2gl(1 - \cos 60)] = mg + mg = 2 mg$$

44

Both kinetic energy and torque have same dimensional formula  $[ML^2T^{-2}]$ .

Resistance and inductance have different dimensional formulae.

Dimensional formula of resistance is

$$[ML^2T^{-3}A^{-2}]$$

Dimensional formula of inductance is  $[ML^2T^{-2}A^{-2}]$ .

Both Young's modulus and pressure have same dimensional formula  $[ML^{-1}T^{-2}]$ .

45

The speed of sound,  $v = \sqrt{\frac{\gamma P}{d}}$

$$\frac{v_1}{v_2} = \sqrt{\frac{d_2}{d_1}} \text{ (As } P \text{ is constant)}$$

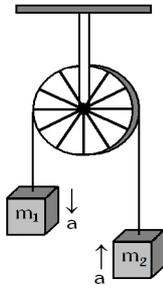
46

Suppose the components of  $\vec{A}$  makes angles  $\alpha, \beta$  and  $\gamma$  with  $x, y$  and  $z$  axis respectively then  $\alpha = \beta = \gamma$

$$\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1 \Rightarrow 3 \cos^2 \alpha = 1$$

$$\Rightarrow \cos \alpha = \frac{1}{\sqrt{3}} \therefore A_x = A_y = A_z = A \cos \alpha = \frac{A}{\sqrt{3}}$$

47



$$a = \left( \frac{m_1 - m_2}{m_1 + m_2} \right) g$$

Here, acceleration of each mass,

Now acceleration of centre of mass of the system,

$$A_{cm} = \frac{m_1 \vec{a}_1 + m_2 \vec{a}_2}{m_1 + m_2}$$

Because both masses move with same acceleration but in opposite direction therefore let,

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

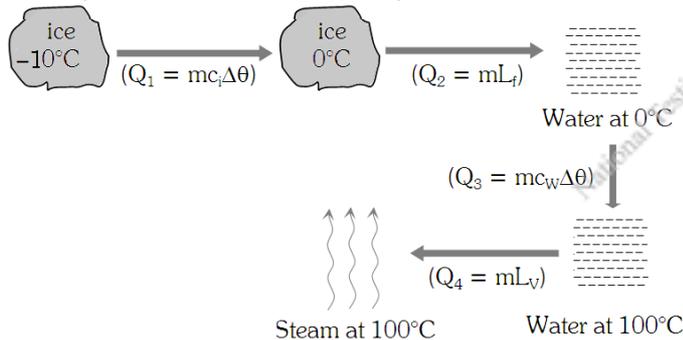
$$\therefore A_{cm} = \frac{m_1 a - m_2 a}{m_1 + m_2}$$

$$\Rightarrow \left( \frac{m_1 - m_2}{m_1 + m_2} \right) \times \left( \frac{m_1 - m_2}{m_1 + m_2} \right) \times g = \left( \frac{m_1 - m_2}{m_1 + m_2} \right)^2 \times g$$

48

The following figure represents the conversion of ice ( $-10^\circ\text{C}$ ) into steam.

( $c_i$  = Specific heat of ice,  $c_w$  = Specific heat of water)



Thus, Total heat required,  $Q = Q_1 + Q_2 + Q_3 + Q_4$

$$\Rightarrow Q = 1 \times 0.5(10) + 1 \times 80 + 1 \times 1 \times (100 - 0) + 1 \times 540 = 725 \text{ Cal}$$

Hence, work done,  $W = JQ = 4.2 \times 725 = 3045 \text{ J}$

49

As force and instantaneous displacement are always perpendicular, work done by centripetal force is always zero. It can be given as,

$$W = \vec{F} \cdot \vec{s} = Fs \cos\theta = Fsc \cos(90^\circ) = 0$$

50

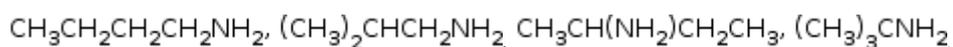
Here, Energy stored per unit volume =  $\frac{1}{2} \times \text{Stress} \times \text{Strain}$

$$\Rightarrow \frac{1}{2} \times \text{Young's modulus} \times (\text{Strain})^2 = \frac{1}{2} \times Y \times x^2$$

## Chemistry - Solutions

1

Four  $1^\circ$  amines are possible in  $\text{C}_4\text{H}_{11}\text{N}$  as below,



2

Four unpaired electron are present in the  $\text{Fe}^{2+}$  ion as  $\text{Fe}_{26}^{2+} = [\text{Ar}] 3d^6, 4s^0$ .

3

The velocity constant becomes double by increasing the temperature by  $10^\circ\text{C}$  thus if at 290 K, velocity constant  $= 3.2 \times 10^{-3}$  then at 300 K, velocity constant  $= 2(K_{290}) = 2 \times 3.2 \times 10^{-3} = 6.4 \times 10^{-3}$ .

4

In electrolysis cation discharged at cathode while anion discharged at anode.

5

Consider the reaction  $\text{S} + 2e^- \rightarrow \text{S}^{2-}$

6

As we know that, hydration energy increases along the period.

7

By the Ostwald's dilution law, as degree of ionization is directly proportional to the dilution.

8

Law of multiple proportions

9

EAN rule means that the effective atomic number of the central metal be equal to the atomic number of next noble gas.

For  $[\text{Fe}(\text{CN})_6]^{4-}$ , Fe is in +2 oxidation state.

$$\text{EAN} = 26 - 2 + (6 \times 2) = 36$$

So, 36 is equal to the atomic number of the next noble gas Kr (36).

10

Generally Br-F contain maximum electronegativity difference when compared with other compound.

11

The molar solution of sulphuric acid is equal to 2 N as it shows dibasic nature.

12

Aldehydes

13

$\text{Ni} > \text{Cu} > \text{Zn} > \text{Sc}$

14

Minimum mass of sulphur = weight of its one atom = 32

As 3.4 gm of sulphur present in 100 gm,

$$\therefore 32 \text{ gm of sulphur present in } = \frac{100 \times 32}{3.4} = 940$$

15

Methyl salicylate

16

Chemical equilibrium

17

Since 22400 ml at NTP has  $6.023 \times 10^{23}$  molecule,

$$\therefore 1 \text{ ml at NTP has } = \frac{6.023 \times 10^{23}}{22400}$$

$$= 0.0002688 \times 10^{23} = 2.69 \times 10^{19}$$

18

As volume is reduced to  $\frac{1}{4}$ , the concentration of each reactant becomes 4 times.

19

As we know,  $\Delta H = \Delta U + \Delta nRT$

As  $\Delta n = -2$ , so  $\Delta H = \Delta U - 2RT$

20

Carnallite is a double salt with the molecular formula  $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ . It yields  $\text{K}^+$ ,  $\text{Mg}^{2+}$  as well as  $\text{Cl}^-$  ions in solution.

21

Solvated electrons

22

High boiling constituents condense at the bottom of the column.

23

48

24

N and P possess 3 unpaired electrons in 2p and 3p respectively and V possess 3 unpaired electrons in 3d.

25

All are correct.

26

Gas present at anode and cathode are

At cathode :  $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$

At anode :  $\text{H}_2\text{O} \rightarrow 2\text{H}^+ + \frac{1}{2}\text{O}_2 + 2\text{e}^-$

27

Since,  $\text{Na}^+$  as well as  $\text{K}^+$  controls blood pressure and heart beat, thus excess of  $\text{Na}^+$  ion increases B.P.

28

For monoatomic gas,  $C_V = \frac{3}{2}R$

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

29



$$x + [(-2) \times 4] = -2 \quad 2x + (-2) \times 7 = -2$$

$$x = 8 - 2 = +6 \quad 2x = 14 - 2 = 12$$

$$x = \frac{12}{2} = +6$$

In this given reaction oxidation as well as reduction are not involved, as there is no change in the oxidation number.

30

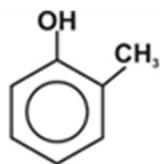
Diethers.

31

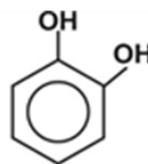
Compounds containing -OH group directly attached to benzene ring are known as phenolic compounds.



Benzenol



o-Cresol



Catechol

32

Because Cs is most electropositive.

33

Here,  $\text{CH}_3\text{COONa} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{Na}^+$

$\text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{OH}^-$

$\text{CH}_3\text{COOH} + \text{NaOH}$

Sodium acetate is strong electrolyte.

34

Given,  $\text{CaCO}_3(\text{s}) \xrightarrow{\Delta} \text{CaO}(\text{s}) + \text{CO}_2(\text{g}) \uparrow$

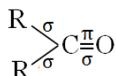
$\text{C}(\text{s}) + \text{CO}_2(\text{g}) \rightleftharpoons 2\text{CO}(\text{g})$

$$\text{Now, } K_{p2} = \frac{[\text{pCO}]^2}{[\text{pCO}_2]} \Rightarrow \text{pCO} = \sqrt{[K_{p1} \times K_{p2}]}$$

$$\Rightarrow \text{pCO} = \sqrt{[8 \times 10^{-2} \times 2]} = \sqrt{16 \times 10^{-2}}$$

$$\text{Partial pressure} \Rightarrow \text{pCO} = 4 \times 10^{-1} = 0.4$$

35



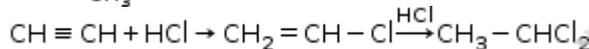
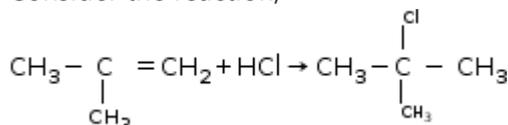
In this case,  $\text{R} \begin{array}{l} \nearrow_{\sigma} \\ \searrow_{\sigma} \end{array} \text{C} \begin{array}{l} \pi \\ \pi \end{array} \text{O}$ .

36

All of the above

37

Consider the reaction,

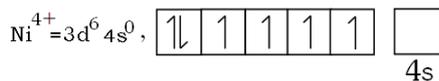
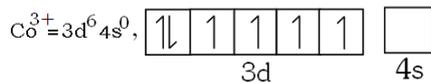


38

$$\text{C}_6\text{H}_6 = \frac{\frac{7.8}{78}}{\frac{7.8}{78} + \frac{46}{92}} = \frac{1}{6}$$

Here, Mole fraction at

39



40

In Lassaigne's test organic compound is fused with sodium.

41

Darzens procedure.

42

Fluorobenzene.

43

By the Le-chatelier principle, when concentration of reactant increases, the equilibrium shift in favour of forward reaction.

44

Zn, Cd and Hg are non typical transition elements as they have complete d-orbitals.

45

Acid

46

Nitrates on reaction with conc.  $\text{H}_2\text{SO}_4$  and  $\text{FeSO}_4$  give a brown ring because of the formation of  $\text{FeSO}_4 \cdot \text{NO}$  or  $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$ .

47

Ethane is a saturated compound and it can not be catalytically hydrogenated.

48

Magnesium chloride is an electrolyte.  $\text{MgCl}_2 \rightleftharpoons \text{Mg}^{++} + 2\text{Cl}^-$ . It is dissociated into ions in aqueous solution.

49

Palmitic acid is represented by  $\text{C}_{15}\text{H}_{31}\text{COOH}$

50

In case of isothermal reversible process, ideal gas has constant temperature and thus  $\Delta U = 0$

## Botany - Solutions

1

Biofertilizer

2

Algae differ from bryophyta because in algae sex organs are usually non-jacketed and in bryophyta sex organs are jacketed with sterile jacket.

3

Krebs' cycle (citric acid cycle) is a complex cycle of enzyme-catalysed reactions, occurring within the cells of all living animals, in which acetate, in the presence of oxygen, is broken down to produce energy in the form of ATP (via the electron transport chain) and carbon dioxide and the cycle is the final step in the oxidation of carbohydrates, fats, and proteins; some of the intermediary products of the cycle are used in the synthesis of amino acids.

4

All the above

5

Chlorophyll-a is an important pigments for photophosphorylation as it is the only pigment that can absorb and convert light energy into chemical energy and so acts as reaction centre. Carotenoids, xanthophylls and phycoerythrin are accessory photosynthetic pigments that absorb light energy of different wavelengths and transfer it to chlorophyll -a.

6

When alien species are introduced unintentionally or deliberately it results in decline in biodiversity e.g., when Nile Perch was introduced into Lake Victoria in East Africa it led to extinction of cichlid fish in the lake. Introduction of water hyacinth led to the environmental damage and threat to our native species in water bodies. The illegal introduction of the African catfish for aquaculture purposes has posed a threat to the indigenous catfishes in Indian rivers.

7

Some plants like Viola (common pansy), Oxalis and Commelina produce two types of flowers: chasmogamous flowers which are similar to flowers of other species with exposed anthers and stigma and cleistogamous flowers which do not open at all. In this flowers the anthers and stigma lie close to each other. When anthers dehisce in the flower buds, pollen grains come in contact with the stigma to affect pollination. So, cleistogamous flowers are invariably autogamous as there is no chance to cross-pollen landing on the stigma. Cleistogamous flowers produce assured seed-set even in the absence of pollinators.

8

Chlorophyll is the primary photosynthetic pigments as it performs primary reaction of photosynthesis that involves conversion of light into chemical energy. A chlorophyll molecules consists of a head called porphyrin and a tail made up of long chain alcohol called phytol. Magnesium forms the central atom of the porphyrin ring of chlorophyll molecule.

9

$C_4$  plants show kranz type of anatomy. In kranz anatomy, the mesophyll is undifferentiated and its cells occur in concentric layers around vascular bundles. The vascular bundles are surrounded by large sized bundle sheath cells which are arranged in wreath like manner in one to several layers. In  $C_4$  plants there are two carboxylation reactions, first in mesophyll chloroplast and second in bundle sheath chloroplast. RuBP or RuBisCo is present in bundle sheath chloroplasts where  $C_3$  cycle takes place.

10

The parenchyma cells are called thin-walled meristematic cells.

11

DCMU (Dichlorophenyl dimethyl urea) breaks the carrier chain between PS-I and PS-II and also break to non-cyclic phosphorylation so that light reaction is blocked.

12

They both have same type of pigments

13

Somatic embryos develop from somatic cells and their development is comparable to that of a zygotic embryo. They are just like a normal embryo except that their development is induced from a diploid somatic cell. Somatic embryo culture is induced by a high

concentration of an auxin. Microspores are haploid cells and do not give rise to somatic embryo.

14

Root

15

Intercalary meristem is present in the nodes of grasses.

16

Viability of seeds are known by testing their: (i) ability to germinate, (ii) ability to respire. All viable seeds respire. This can be tested by immersing a section of seed containing the embryo in 0.1% solution of triphenyl tetrazolium chloride. The viable embryo will turn pink because of conservation of colourless triphenyl tetrazolium chloride into insoluble coloured dye known as triphenyl formazan due to reduction.

17

Bamboo breeds only once in lifetime. Monocarpic plants are the plants that flower only once in their life and after flowering, they produce fruits and die. All annual (e.g. wheat, rice) and biennial (e.g. carrot, radish) plants and a few perennial plants are monocarpic. A few monocarpic plants exhibit unusual flowering phenomenon e.g. certain bamboo species (*Bambusa tulda*) flower only once in their life time, generally after 50-100 years, produce large number of fruits and die.

18

RrYy is a dihybrid, thus four type of gametes are formed as RY, Ry, rY, ry.

19

The outer layer of a mature pollen grain is known as exine (which is made up of sporopollenin) and inner to it is intine (made up of pecto-cellulose). At certain places, exine remains thin and lacks sporopollenin. These areas are termed as germ pores. In pollen germination, pollen tube come out through these pores.

20

Oogamy is most advanced type of reproduction in which male gamete is motile smaller and non food storing. It is called antherozoid while female gamete is food storing, nonmotile larger called oogonium.

21

German biologists

22

Microbes play an important role in ecosystem.  $N_2$ -fixing organisms like bacteria and cyanobacteria convert atmospheric nitrogen into nitrogenous compounds by the process of biological  $N_2$ -fixation. Decomposer organism e.g. some bacteria and fungi break down complex organic matter into simple inorganic substances like carbon-dioxide, water and nutrients by the process of decomposition.

23

Ethanol and  $CO_2$

24

Sclerenchyma is simple mechanical tissue. The term sclerenchyma was introduced by Mettenius(1865). Mature sclerenchyma cells are dead and empty and these cells have highly thickened and usually lignified, secondary cell wall. The cell cavity (lumen) is highly reduced and sometimes almost closed (obliterated). Sclerenchyma cells may be short or long. On the

basis of cell length, sclerenchyma cells are classified into two general types namely, fibres and sclereids. Fibres give mechanical strength and rigidity to the plant organs.

25

Polyarch condition is not characteristic of dicot root as it is a characteristic of monocot root in which numerous vascular bundles are present. Dicot root is diarch to hexarch i.e., 2-6 xylem and phloem patches are present and pith in a dicot root, is either absent or is inconspicuous.

In dicot root, phloem and xylem bundles are separated from each other by one or more layers of small thin walled cells termed as conjunctive parenchyma, which later on becomes meristematic to form vascular cambium.

26

Gregor Johann Mendel (1822-1884) is known as Father of Genetics as he was the first to demonstrate the mechanism of transmission of characters from one generation to the other. He conducted hybridization experiments on Garden pea (*Pisum sativum*) for 7 years (from 1856-1863). Initially, he selected 34 pairs of varieties of pea plants, then 22, but ultimately worked with only 7 pairs of varieties.

27

Respiration

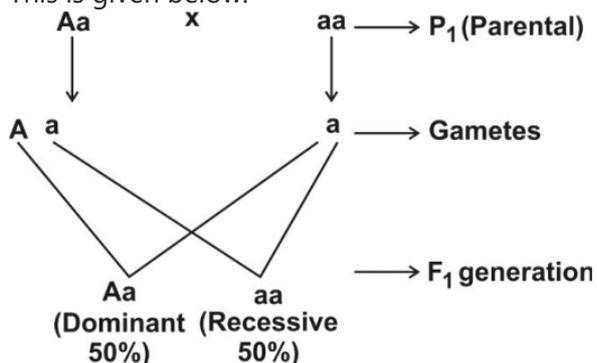
28

Benthos is the community of organisms which live on, in, or near the sea bed, also known as the benthic zone. As no light is available in this zone of sea, the energy source for deep benthic ecosystem is often organic matter from higher water column which drifts down to the depths. This dead and decaying matter sustains the benthic organisms, and thus, most organisms in benthic zone i.e., in deep oceanic waters, are scavengers or detritivores.

29

If a cross between two individuals produces off spring with 50% dominant character (A) and 50% recessive character (a), then Aa and aa will be the genotypes of parents.

This is given below:



30

Keystone species which have significant and disproportionately large influence on the community. Removal or decrease in their number causes disruption in structure and function of community. Example is in intertidal regions starfish feeds on mussels. Removal of starfish leads to dominance of mussels that excludes algae and browsing species. In tropical rainforests, fig trees function as keystone species as they provide fruits to a number of animals during the period of food scarcity.

31

Root hairs enhance the exposed surface area of the root, for the absorption of water from the soil.

32

Mitosis is divided into four phases: prophase, metaphase, anaphase and telophase respectively. In prophase the indistinct and intertwined DNA molecules condense to form elongated chromosomes. During prometaphase, the nuclear membrane disintegrates. In metaphase, the chromosomes align themselves at the equatorial plate. Whereas in anaphase, centromere of each chromosome divides into two so that each chromosome comes to have its own centromere. Chromatids move towards opposite poles along the path of their chromosome fibres. Finally during telophase, two chromosome groups reorganize to form two nuclei. Nuclear envelope reappears, Golgi complex and endoplasmic reticulum are reformed, etc. Crossing over occurs during meiosis.

33

Amoeba, Euglena, Chlamydomonas

34

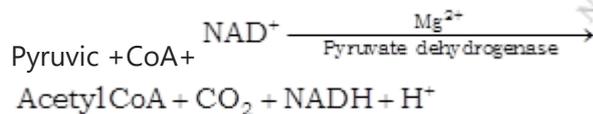
In sexual reproduction offsprings are not genetically identical to the parents. They show variations because they receive characters from two different parents.

35

Bolting is elongation of reduced stem and gibberellins induce subapical meristem to develop faster which elongates reduced stems e.g., cabbage, radish etc. A weekly dose of 0.1 mg gibberellic acid makes cabbage plants to grow taller than 3.5 m. Normally bolting occurs at the onset of reproductive phase. It is favoured in nature by either cold night or long days.

36

Pyruvate formed in the process of glycolysis enters mitochondrial matrix and undergoes oxidative decarboxylation by a complex set of reactions catalyzed by pyruvic dehydrogenase and NAD<sup>+</sup>, acetyl CoA and CO<sub>2</sub> is produced.



Acetyl CoA enters the TCA cycle.

37

S- phase is also known as synthetic phase. In this phase of cell cycle, the chromosomes replicate and for this their DNA molecules function as templates and form carbon copies. The DNA content doubles i.e., 1C to 2C for haploid cells and 2C to 4C for diploid cells. It results in duplicate sets of genes are formed. Along with replication of DNA new chromatin fibres are formed which, remain attached in pairs and the number of chromosomes does not increase. As chromatin fibres are elongated chromosomes, each chromosome comes to have two chromatin threads or sister chromatids thread or sister chromatids which remain attached at a common point called centromere.

38

Viability of seeds can be tested by two methods:

(i) ability to germinate, (ii) testing their ability to respire.

All viable seeds respire. This can be tested by immersing a section of seed containing the embryo in 0.1% solution of triphenyl tetrazolium chloride. The viable embryo will turn pink because of conversion of colourless triphenyl tetrazolium chloride into insoluble coloured dye known as triphenyl formazone due to reduction.

39

Senescence is the process of ageing caused by cellular breakdown, increased metabolic failure, increased entropy etc. It takes place in the period between reproductive maturity and

death. Cell division followed by cell enlargement and differentiation, precede the actual separation. Senescence of cell in distal region lead to lignification of cell wall. Tylose formation in tracheary element and callose deposition in sieve elements which occur in advance of abscission (i.e. senescence) finally, lead to actual separation. So, vessels and tracheid (tracheary elements) differentiation indicates senescence.

40

22 chromosomes

41

The transfer of food energy from producers to consumers by a series of organisms with repeated eating and being eaten is called as food chain. Green plants are always the first component of food chain as they alone are capable of synthesizing organic food by using light energy in photosynthesis. The logical sequence of a food chain is :

Producer → Consumers → Decomposer

Small plants → Zooplanktons → Fish → Man  
(Primary producer)      (Primary consumer)      (Secondary consumer)      (Tertiary consumer)

42

Intercalary meristems are present mostly at the base of node (nodal region) (e.g. Mentha viridis, Mint), base of internode (e.g. stem of wheat, grasses), and the base of the leaf (e.g. Pinus).

43

Lie big (1943) proposed the law of minimum which states that "when a process such as growth is governed by a number of separate factors, the rate of the process is limited by pace of the slowest factor."

44

The total number of species evaluated is about 1.74 million. Out of these, the number of known species in India is 1,42,000 or roughly 8-8.1% of the total though India has only 2.4% land area. India with about 45000 species of plants and twice as many species of animals is one of the 12 megadiversity countries of the world.

45

10

46

Metaphase

47

Mixotrophic nutrition found in Euglena, when light is available it is photosynthetic and in darkness, it is saprophytic.

48

Francis Harry Compton Crick pursued his graduation (B. Sc) in Physics at University College, London in 1937 and started his research for Ph D. in British Admiralty but was interrupted by the outbreak of war in 1939. So he left Admiralty in 1947 to study Biology. He along with I.D. Watson discovered the double helical structure of DNA and its semi-conservative replication scheme.

49

Somatic hybridization refer to the process of producing somatic hybrids by the fusion of somatic cells of two varieties or species. In this process, the protoplasts (plant cells without

cells walls) of two plants are made to fuse together in a solution of polyethylene glycol (PEG) or sodium nitrate. Protoplast fusion involves the fusion of cytoplasm as well as nuclei. The fused protoplasts are then allowed to grow on culture medium, develop their own walls and are now referred to as somatic hybrid cells.

50

In electron transport chain cycles,  $O_2$  is directly used. An ETC couples a reaction between an electron donor (such as NADH) and an electron acceptor (such as  $O_2$ ) to the transfer of  $H^+$  ions across a membrane, through a set of mediating biochemical reactions. This creates proton gradient across the membrane which is used to produce adenosine triphosphate (ATP).

## Zoology - Solutions

1

Somatostatin from the hypothalamus inhibits the release of growth hormone from the pituitary and these hormones originating in the hypothalamic neurons, pass through axons and are released from their nerve endings. These hormones reach the pituitary gland by a portal circulator system and regulate the functions of the anterior pituitary and the posterior pituitary is under the direct neural regulation of the hypothalamus.

2

All nerve cells whose fibre release acetylcholine. This is soon hydrolysed by an enzyme acetylcholinesterase that is present in high concentration in synaptic fluid.

3

Colour blindness is disorder of vision in which colours are confused. Red- green colour blindness is the most common type. Colour blindness is because of recessive gene carried on the X- chromosome and so men are more likely to show the defect although women may be carriers. It results in absence or malfunctioning of one or more of the three types of cone cells responsible for colour vision.

4

As they are the ultimate products of protein catabolism.

5

Migration is the movement of individuals into or out of a place or country. Migration of individual into a country is called immigration and out of the country as emigration.

6

The events not associated with ovulation in human female is decrease in estradiol. In human females, ovulation is the release of secondary oocyte from the ovary at about 14<sup>th</sup> day of the menstrual cycle. In the period both LH and FSH attain a peak level. Rapid secretion of LH induces rupturing of fully developed Graafian follicle and thus ovum release. LH surge is actually responsible for ovulation.

7

primary oocyte in the Graafian follicle

8

NA

9

The amniocentesis is the most widely used method for prenatal detection of many genetic disorders.

10

Chemo €" heterotrophic

11

Hypertension is the most common disease affecting the heart and blood vessels and it is the main cause of high blood pressure. A blood pressure of 120/80 is considered normal. But the increase in blood pressure beyond 140 mm Hg (systolic) and 90 mmHg (diastolic) is known as high blood pressure (hypertension). High blood pressure can harm heart, brain, kidneys and eyes. When blood pressure is high, the heart uses more energy in pumping.

12

Charles Robert Darwin come back to England in October 1836 from his 5-year expedition. On returning, he analysed and processed his observations prepared during the journey. During this, he came across Malthus's theory of human population and received a brief essay from Alfred Wallace. He combined all his studies and finally in November 1859, Darwin published his observations and conclusions in the form of book. The full title of his book was 'On the origin of species by means of Natural Selection : The Preservation of Races in the Struggle for life'.

13

O

14

Each inter vertebral disc has an outer fibrous ring containing fibro cartilage.

15

Polymerase chain reaction is used for amplify a small DNA fragment to obtain its large quantity. PCR is used in DNA fingerprinting in such cases where the culprit has to be identified from a very small blood, semen or other cell sample from a crime scene. RFLP (Restriction fragment length polymorphism) corresponds to the occurrence of different cleavage sites for restriction enzymes in the DNA of different individuals of the same species and RFLPs have provided geneticists with a powerful set of genetic markers for gene mapping and gene tracking.

16

'Bundle of His' is a part of heart of human. A bundle of nodal fibres, atrioventricular bundle (AV bundle), continues from the atrioventricular node (AVN) and passes through the atrioventricular septa. It emerges on the top of the interventricular septum and immediately divides into a right and left bundle, which give rise to minute fibres throughout the ventricular musculature of the respective sides known as Purkinje fibres and these fibres along with right and left bundles are known as Bundle of His.

17

Partial pressure of oxygen and carbon dioxide in healthy human lung alveoli are 104 and 40 mm Hg. The partial pressure of oxygen ( $pO_2$ ) in the alveoli is higher (104 mm Hg) than that in the deoxygenated blood in the capillaries of the pulmonary arteries (95 mmHg). As the gases diffuse from a higher to a lower concentration, the movement of oxygen is from the alveoli to the blood and the reverse is the case in relation to carbon dioxide. The partial pressure of carbon dioxide ( $pCO_2$ ) is higher in deoxygenated blood (45 mm Hg) than in alveoli (40 mm Hg), so, carbon dioxide passes from the blood to the alveoli.

18 Information across the synaptic cleft is transmitted by means of a chemical neurotransmitter in small vesicle

19 Neurohypophysis (pars nervosa or posterior lobe) is with two types of groups of neurosecretory cells, called nuclei which secrete neuropeptide hormones -oxytocin and vasopressin and it is stored in the end knobs of the axons present in posterior lobe of pituitary and are released in blood when required, therefore these are also known as neurohypophyseal hormones.

20 A keystone species has disproportionately large effect on its environment relative to its abundance. They play a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and number of various other species in the community.

21 Hormone produced in thyroid stimulates metabolism

22 Polymerase chain reaction is used to amplify a DNA fragment to obtain its large quantity. PCR is helpful in DNA fingerprinting in such cases where the culprit has to be identified from a very small blood, semen or other cell sample from a crime scene. RFLP (Restriction fragment length polymorphism) refers to the occurrence of different cleavage sites for restriction enzymes in the DNA of different individuals of the same species and RFLPs have provided geneticists with a powerful set of genetic markers for gene mapping and gene tracking. It is used in DNA fingerprinting.

23 Corpus luteum is responsible for the production of progesterone, (the hormone responsible for the maintenance of endometrium). Progesterone hormone is secreted by the corpus luteum of the ovary. It stimulates further development of the uterine epithelium and mammary glands and also required for the formation of the placenta and for the maintenance of pregnancy.

24

(i)	(ii)	(iii)	(iv)
Natural	Periodic abstinence	Coitus Interruptus	Lactational amenorrhea

25 Oxygen is the most important factor controlling the rate of red cell production in the oxygen content of the arterial blood, a decrease in oxygen content stimulates erythropoiesis.

26 Primary metabolites

27  $A = q; B = t; C = s; D = r$

28 NA

29 There are no side effects of tubectomy and vasectomy. Preventing egg formation is the purpose of tubectomy. Contraceptive pills help in birth control by preventing ovulation.

Genital warts is a sexually transmitted disease caused by human papilloma virus (HPV). In India, there is rapid decline in IMR and MMR due to better health facilities.

30

The Bowman's capsule responsible to proximal convoluted tubule lined by brush bordered cuboidal epithelial cells with numerous microvilli, which increase the surface area for absorption. The cells have numerous mitochondria near the basolateral surface, which allow active transport and selective reabsorption of sodium, calcium, glucose, amino acids, water etc., This is called as selective tubular reabsorption.

31

$\text{Ca}^{2+}$  is the main ion involved in nerve impulse transmission. When an impulse arrives at a presynaptic knob, calcium ions from the synaptic cleft enter the cytoplasm of the presynaptic knob. The calcium ions responsible for the movement of synaptic vesicles to the surface of the knob. The synaptic vesicles are fused with the presynaptic membrane and get ruptured to discharge their contents (neurotransmitter) into the synaptic cleft. So,  $\text{Ca}^{2+}$  ions are required during nerve- impulse transmission.

32

Zoological name of starfish is *Asterias*, it belongs to phylum Echinoderm.  
Zoological name of jellyfish is *Aurelia*, it belongs to phylum Cnidaria.  
Zoological name of devilfish is *Mobula* of class Elasmobranchii.  
Zoological name of cuttlefish is *Sepia*, it belongs to phylum Mollusc.  
Therefore, the correct answer is option C.

33

**A-3, B-2, C-6, D-1, E-5, F-4**

34

Podocytes are a layer of specialized epithelial cells in Bowman's capsule of kidney with major foot like processes, each supporting a series of minor processes. These minor processes are interwoven with those from other podocytes to form a number of slits, through which filtration can occur and these slits which is approximately 0.1 mm wide permit the passage of all plasma constituents but act as a barrier to blood cells.

35

When sewage mixes with water body, the increased microbial activity uses up dissolved oxygen. Microbes present in it biodegrade organic matter of sewage using oxygen which results into a sharp decline in dissolved oxygen which may cause mortality of aquatic creatures. Gradually, however, dissolved oxygen increases in concentration with the completion of biodegradation of sewage matter.

36

Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled as there is a negative intrapleural pressure pulling at the lungs walls. Intrapleural pressure refer to the pressure of air within the pleural cavity. It is always negative and acts like a suction to keep the lungs inflated and prevent them from collapsing. The negative intrapleural pressure is due to three main factors: surface tension of the alveolar fluid; elasticity of lungs; elasticity of thoracic wall. Generally, there is a difference between intrapleural and intrapulmonary pressure, which known as transpulmonary pressure. This transpulmonary pressure creates the suction to keep the lungs inflated. If there is no pressure difference, there is no suction and lungs will collapse.

37

In humans the oocyte is maintained in a state of meiotic arrest by granulosa cells secretions. The follicular cells proliferate and become multilayered also known as granulosa cells, which secrete oestrogens. The granulosa cells are stimulated to proliferate by the action of activin, a signaling protein which is released by the oocyte. FSH also acts on the granulosa cells, and enhances the action of activin and the granulosa cells secrete meiosis inhibiting factor (MIF) that leads to meiotic arrest.

38

Inside the larynx, vocal cords are present. These are 2 pairs of fold of mucous membrane which extend into the lumen of the larynx from the sides.

39

Sutures forming the cranium is not a synovial joint. Synovial joints show a considerable movement and there is a synovial membrane composed of secretory epithelial cells which secrete thick, sticky synovial fluid. It lubricates joint, provides nutrients and helps to maintain the stability of joint. Synovial joints are gliding joint, hinge joint, pivot joint, ball and socket joint, saddle joint, condyloid joint. Sutures forming the cranium are examples of fibrous or immovable joints.

40

Hormone action involves their reception by target cells, specific proteins known as hormone receptors that are located in target tissues only bind with these hormones. Hormone receptors may be of two types: membrane bound receptors and intracellular receptors. Steroid hormones etc., bind with intracellular receptors while some hormones e.g., bind pituitary hormones like FSH etc., bind with membrane bound receptors.

41

Carbonic anhydrase is an enzyme present in RBCs that catalyses the reaction between carbon dioxide and water to form carbonic acid, which subsequently dissociates into  $H^+$  and  $HCO_3^-$  ions. This reaction is one of the fastest known biological reactions and controls the elimination of carbon dioxide from the body.

42

Lactic acid bacteria (LAB) grow in milk and convert it to curd, by increasing vitamin  $B_{12}$  it improve its nutritional quality. Fermentation with lactic acid bacteria increases the nutritive value of food due to improved bioavailability and can enhance the absorption of protein and minerals, particularly calcium, iron, zinc, magnesium, phosphorus and copper. Lactic acid bacteria can synthesize the vitamins folic acid, thiamine, niacin, riboflavin and vitamin  $B_{12}$ , a water soluble, unstable to light and temperature, an essential vitamin in the human diet.

43

B-lymphocytes

44

The male sex accessory ducts include rete testis, vasa efferentia, epididymis and vas deferens. The seminiferous tubules of the testis open into the vasa efferentia by rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis.

Therefore if vasa efferentia gets blocked, the gametes will not be transported from testes to epididymis.

45

Starch and cellulose are homopolymers made from glucose. Chitin is produced from acetyl glucosamine. Dextran is synthesized from sucrose by certain lactic-acid bacteria, like *Leuconostoc* and *Streptococcus mutans*

46

Neurotransmitter is a chemical substance, which functions for transmission of nerve impulse across synapse. It is released by synaptic vesicle into the synaptic cleft. Neurotransmitter binds with protein receptor molecule present on post synaptic membrane causing its depolarization and generation of action potential.

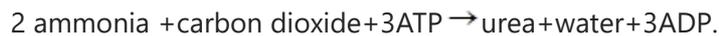
47

Antennae

48

The principal nitrogenous excretory compound in humans is synthesised in the liver, but eliminated mostly through kidneys. When a cell metabolically breaks down amino acids, ammonia, a toxic compound formed as byproduct. Ammonia is toxic in even small amounts and must be removed from the body. The urea cycle or the ornithine cycle describes the conversion reactions of ammonia into urea. As these reactions occur in the liver, the urea is then transported to the kidneys where it is excreted.

The overall urea formation reaction is:



49

Palmitic acid fatty acids is liquid at room temperature. A fatty acids molecule is an unbranched chain of carbon atoms with a carboxyl (-COOH) group at one end. There are two types of fatty acids- saturated (with single bonded carbons) and unsaturated with double bonded carbon atoms). Unsaturated fatty acids e.g. oleic acid, linoleic, linolenic acid etc. remain liquid at room temperature as their melting points are quite low.

50

Sodium is not a second messenger in hormone action. Second messenger is a chemical within a cell which responsible for initiating the response to a signal from a chemical messenger (such as a hormone, neurotransmitter, or growth factor) that cannot enter the target cell itself, for example because it is no lipid -soluble and is therefore unable to cross the plasma membrane. eg. of second messenger are calcium, cAMP, cGMP. Sodium is not a second messenger.