Physics

1

A body of mass 0.05 kg is observed to fall with an acceleration of $9.5\,\mathrm{m\,s^{-2}}$. What is the opposing force of air on the body? $\left(g = 9.8\,\mathrm{m\,s^{-2}}\right)$

1	0.15 N
2	0.015 N
3	0.030 N
4	0

2

A body of mass 10 kg at rest is acted upon simultaneously by 2-forces 4 N and 3 N at right angles to each other. Find the kinetic energy of the body at the end of 10 seconds.

1	50 J
2	100 J
3	125 J
4	300 J

3

Given: $\vec{A} = 2\hat{i} + 3\hat{j}$, then find the angle between $\vec{A}$ and y-axis.

1	$\tan^{-1} 2/3$
2	$\cos^{-1} 2/3$
3	$\sin^{-1} 2/3$
4	$\tan^{-1} 3/2$

4

In MKS system, dimensions of emf are:

1	$[ML^2T^{-2}Q^{-1}]$
2	$[MLT^{-2}Q^{-1}]$
3	$[ML^2T^{-2}Q^{-2}]$
4	$[ML^{-1}T^{-2}Q^{-2}]$

5

When a certain weight is suspended from a long uniform wire, its length increases by 1 cm. If the same weight is suspended from another wire of the same material and length but having a diameter half of the first one, then determine the increase in length.

1	8 cm
2	4 cm

3	2 cm
4	0.5 cm

6

If $A = 3\hat{i} + 4\hat{j}$ and $B = 7\hat{i} + 24\hat{j}$ the vector having the same magnitude as B and parallel to A is

1	$15\hat{i} + 10\hat{j}$
2	$5\hat{i} + 20\hat{j}$
3	$15\hat{i} + 20\hat{j}$
4	$20\hat{i} + 15\hat{j}$

7

If the mass as well as diameter of a planet have twice the value of the corresponding parameters of earth. Then find the acceleration due to gravity on the surface of the planet.

1	4.9 m/s^2
2	9.8 m/s^2
3	19.6 m/s^2

490 m/s^2

8

A string breaks if its tension exceeds 10 newtons. A stone of mass 250 gm tied to this string of length 10 cm is rotated in a horizontal circle. Then find the maximum angular velocity of rotation.

1

200 rad/s

2

100 rad/s

3

40 rad/s

4

20 rad/s

9

Pressure P, volume V and temperature T of a gas in the jar A and the other gas in the jar B at pressure 2P, volume V/4 and temperature 2T, then what will be the ratio of the number of molecules in the jar A to jar B?

1

4:1

2

2:1

3

1:2

4

1:1

10

A body of length 1 m having cross sectional area 0.75 m² has heat flow through it at the rate of 6000 Joule/s. If $K = 200$ Jm^{-1}K^{-1}, then find the temperature difference.

1	100°C
2	80°C
3	40°C
4	20°C

11

Let m_1 and m_2 be two masses of particles initially at rest. They start moving towards each other under their mutual force of attraction. Which of the following expression represents the speed of the centre of mass at any time 't' if they are at a distance 'r' apart?

1	$\left(G\dfrac{m_1m_2}{r^2} \cdot \dfrac{1}{m_1+m_2}\right)t$
2	$\left(G\dfrac{m_1m_2}{r^2} \cdot \dfrac{1}{m_2}\right)t$
3	$\left(G\dfrac{m_1m_2}{r^2} \cdot \dfrac{1}{m_1}\right)t$
4	0

12 What the maximum value of static friction is called?

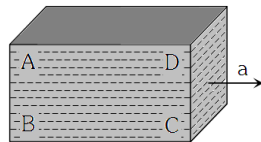**1** Coefficient of friction

2 Normal reaction

3 Rolling friction

4 Limiting friction

13 A closed rectangular tank is completely filled with water and is accelerated horizontally with an acceleration 'a' towards right. Determine the points where pressure is (i) maximum and (ii) minimum.

1 (i) B (ii) A

2 (i) B (ii) C

3 (i) B (ii) D

4 (i) C (ii) D

14

The velocity of a freely falling body changes as $g^P h^q$, where 'g' is acceleration due to gravity and 'h' is the height. Then find the values of P and q.

1	1,1
2	$1, \dfrac{1}{2}$
3	$\dfrac{1}{2}, \dfrac{1}{2}$
4	$\dfrac{1}{2}, 1$

---

15 A bullet fired into a fixed target loses half of its velocity after penetrating 3 cm. How much further it will penetrate before coming to rest assuming that it faces constant resistance to motion?

1	1.0 cm
2	1.5 cm
3	2.0 cm
4	3.0 cm

---

16 A wooden stick 2 m long is floating on the surface of water. The surface tension of water 0.07 N/m. By putting soap solution on one side of the sticks the surface tension is reduced to 0.06 N/m. What will be the net force on the stick?

1	0.01 N

2	0.02 N
3	0.06 N
4	0.07 N

17

A body of mass 6 kg is under a force which causes displacement in it given by $S = \dfrac{t^2}{4}$ metres where 't' is time. Calculate the work done by the force in 2 seconds.

1	1 J
2	3 J
3	6 J
4	9 J

18

A person walks on a straight road from his home to a market 2.5 km away with a speed of 5 km/hr. Finding the market closed, he instantly turns and walks back home with a speed of 7.5 km/hr. What is the average speed of the person over the interval of time 0 to 40 min?

1	5 km/hr
2	$\dfrac{30}{4}$ km/hr

3	$\dfrac{45}{8}$ km/hr
4	$\dfrac{50}{4}$ km/hr

19

Wire of length 2 m is made from 10 cm^3 of copper. A force F is applied so that its length increases by 2 mm. Another wire of length 8 m is made from the same volume of copper. If the force F is applied to it, then how much increase is there in the length?
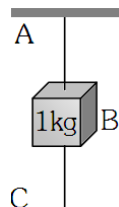
1	1.6 cm
2	2.4 cm
3	3.2 cm
4	0.8 cm

20

A mass of 1 kg is suspended by a string A as shown in the below figure. Another string C is connected to its lower end. What will happen if a sudden jerk is given to C?

1	The portion BC of the string will break
2	The mass will start rotating

3	The portion AB of the string will break
4	None of the strings will break

21

Coefficient of real expansion of mercury is $0.18 \times 10^{-3}/°C$. If the density of mercury at $0°$ C is 13.6 gm/cc, then calculate its density at 473 K.

1	26.22 gm/cc
2	52.11 gm/cc
3	13.11 gm/cc
4	None of these

22

A block of mass 1 kg lies on a horizontal surface in a truck, the coefficient of static friction between the block and the surface is 0.6. The force of friction on the block if the acceleration of the truck is $5\,m/s^2$ is _____. (Take $g = 10\,m/s^2$)

1	8 N
2	7 N
3	6 N

4	5N

23

A boat takes 2 hours to travel 8 km and back in still water. Calculate the time taken for going upstream 8 km and coming back, if the velocity of water is 4 km/hr.

1	1 hr 20 min.
2	2 hr.
3	2 hr 40 min.
4	Insufficient data given

24

If heat given to a system is 6 kcal and work done is 6 kJ. Then find the change in internal energy?

1	Zero
2	25 kJ
3	19.1 kJ
4	12.5 kJ

25

One dimensional motion of the following is:

1. Train running on a straight track

2. Landing of an aircraft

3. Earth revolving a round the sun

4. Motion of wheels of a moving trains

26

A heavy uniform chain lies on a horizontal table-top. If the coefficient of friction between the chain and table surface is 0.25, then what is the maximum fraction of length of the chain, that can hang over one edge of the table?

1. 15%

2. 20%

3. 25%

4. 35%

27

Find the maximum acceleration of the particle doing the SHM $y = 2\sin\left[\dfrac{\pi t}{2} + \phi\right]$, where 2 is in cm.

1.

$$\frac{\pi^2}{4} \, cm/s^2$$

2	$$\frac{\pi}{4} \, cm/s^2$$
3	$$\frac{\pi^2}{2} \, cm/s^2$$
4	$$\frac{\pi}{2} \, cm/s^2$$

28

A bob of mass 10 kg is attached to wire 0.3 m long. Its breaking stress is $4.8 \tilde{A}—10^7$ N/m². The area of cross section of the wire is 10^{-6} m². Evaluate the maximum angular velocity with which it can be rotated in a horizontal circle.

1	1 rad/s
2	2 rad/s
3	4 rad/s
4	8 rad/s

29

A pan with set of weights is attached with a light spring. When disturbed, the mass-spring system oscillates with a time period of 0.6 s. When some additional weights are added then time period is 0.7s. The extension caused by the additional weights is approximately given by

1	1.38 cm

2	1.75 cm
3	2.45 cm
4	3.5 cm

---

30 The mass M is divided into 2 parts xM and (1 - x)M. For a given separation, determine the value of 'x' for which the gravitational attraction between the 2 pieces becomes maximum.

1	2
2	1
3	$\dfrac{3}{5}$
4	$\dfrac{1}{2}$

---

31 If a body starts from rest and travels 120 cm in the 6th second, then determine the acceleration.

1	$0.03 \, \text{m/s}^2$
2	$0.20 \, \text{m/s}^2$
3	$0.027 \, \text{m/s}^2$

| 4 | 0.218 m/s² |

32

A force $F = (5\hat{i} + 3\hat{j})N$ is applied over a particle which displaces it from its origin to the point $r = (2\hat{i} - 1\hat{j})$ metres. Evaluate the work done on the particle.

1	-7 Joules
2	7 Joules
3	11 Joules
4	13 Joules

33

A circular road of radius 1000 m has banking angle 45°. What will be the maximum safe speed of a car having mass 2000 kg, if the coefficient of friction between tyre and road is 0.5?

1	86 m/s
2	99 m/s
3	124 m/s
4	172 m/s

34

The same retarding force is applied to stop a train. After covering a distance of 80 m, the train stops. If the speed is doubled, how long will be the distance covered?

1. Half

2. Double

3. 4 times

4. Same

35

A square frame of side L is dipped in a liquid. On taking out, a membrane is formed. If the surface tension of the liquid is T, then find the force acting on the frame.

1. 10 TL

2. 8 TL

3. 2 TL

4. 4 TL

36

Find the depth below the surface of the earth, where acceleration due to gravity 'g' will be half its value 1600 km above the surface of the earth.

| 1	1.59×10^6 m
2	4.3×10^6 m
3	3.19×10^6 m
4	None of these

37

A figure has been drawn with ink of uniform line-thickness. Let 'm' is the mass of ink used to draw each of the two inner circles, and each of the two line segments. The mass of the ink used to draw the outer circle is 6 m. The coordinates of the centres of the different parts are: outer circle (0, 0), left inner circle (-a, a), right inner circle (a, a), vertical line (0, 0) and horizontal line (0, -a). Then find the y-coordinate of the centre of mass of the ink in this drawing.
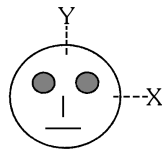
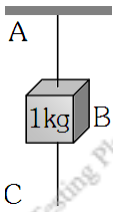| 1	$\dfrac{a}{3}$
2	$\dfrac{a}{8}$
3	$\dfrac{a}{10}$
4	$\dfrac{a}{12}$

38

A mass of 1 kg is suspended by a string A as shown in the below figure. Another string C is connected to its lower end. What will happen if the string C is stretched slowly?

A

1kg B

C

1	The portion BC of the string will break
2	The portion AB of the string will break
3	None of the strings will break
4	None of the above

39

A body is moving under the action of two forces $\vec{F_1} = 2\hat{i} - 5\hat{j}; \ \vec{F_2} = 3\hat{i} - 4\hat{j}$. Its velocity will become uniform under a third force $\vec{F_3}$ is given as

1	$5\hat{i} + \hat{j}$
2	$-5\hat{i} - \hat{j}$
3	$5\hat{i} - \hat{j}$
4	$-5\hat{i} + 9\hat{j}$

40

Two wires A and B are of same materials. Their lengths are in the ratio 1:2 as well as diameters are in the ratio 2:1 when stretched by force F_A and F_B, they get equal increase in their lengths. Then find the ratio F_A / F_B.

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

41

Which of the following relation shows that 'with rise in temperature, the density of a given body changes'?

1	$\rho = \rho_0[1 - \gamma d\theta]$
2	$\rho = \rho_0[1 + \gamma d\theta]$
3	$\rho = \rho_0 / \gamma d\theta$
4	$\rho = \rho_0 \gamma d\theta$

42

A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. What is the weight of the block?

1	2 N
2	100 N

3	50 N

4	20 N

43

State the reason of weightlessness in a satellite.

1	Centre of mass

2	Zero reaction force by satellite surface

3	Zero gravity

4	None of the above

44

Following figure shows that 4-bodies of equal mass start moving with same speed. The combination in which the centre of mass remain at origin is:
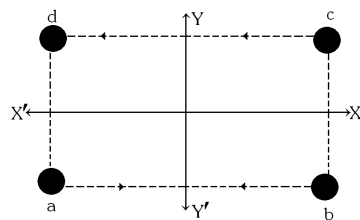
1	a and b

2	a and c

3	b and d

4

c and d

45

A four-wheeler is moving on a circular path and takes a turn. When R_1 and R_2 be the reactions on the inner and outer wheels respectively, then the correct condition is:

1

$R_1 < R_2$

2

$R_1 = R_2$

3

$R_1 > R_2$

4

$R_1 \geq R_2$

46

A cart of mass M is tied by one of end of a massless rope of length 10 m. The other end of the rope is in the hands of a man of mass M. The entire system is on a smooth horizontal surface. The man is at x = 0 and the cart at x = 10 m. At which point the man and the cart will meet when the man pulls the cart by the rope?

1

x = 5 m

2

x = 10 m

3

x = 0

4

They will never meet

47

Find the unit vector which is parallel to the resultant of the vectors $\vec{A} = 4\hat{i} + 3\hat{j} + 6\hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} - 8\hat{k}$.

1	$\dfrac{1}{49}(3\hat{i} + 6\hat{j} - 2\hat{k})$
2	$\dfrac{1}{49}(3\hat{i} - 6\hat{j} + 2\hat{k})$
3	$\dfrac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$
4	$\dfrac{1}{7}(3\hat{i} + 6\hat{j} + 2\hat{k})$

48

Both a micro-wave and an ultrasonic sound wave have same wavelength. Then determine the ratio of their frequencies.

1	10:1
2	10^2:1
3	10^4:1
4	10^6:1

49

Angular momentum have which of the following units?

1	$kg - m - s^2$
2	$Joule/s$
3	$Joule - s$
4	$kg - m^2/s^2$

50 Equal masses of water and a liquid of density 2 are mixed together, then how much density the mixture has?

1	4/3
2	3/2
3	2/3
4	3

Chemistry

1 The cause of the diagonal relationship is

1	same atomic weights of the elements
2	same number of valency electrons in the elements

3	similar e/r ratio of the elements
4	similar electronic configuration of the elements

2 Find the least soluble compound.

1	MgF_2
2	CaF_2
3	SrF_2
4	BeF_2

3 Chloride of an element A gives neutral solution in water. To which of the following group, element A belongs?

1	fifth group
2	first group
3	third group
4	first transition series

4

Hydrogen combines with oxygen in which 16 g of oxygen combine with 2 g of hydrogen to form H_2O. Hydrogen also combines with carbon to form CH_4 in which 2 g of hydrogen combine with 6 g of carbon. If carbon and oxygen combine together then they will be in the ratio of:

1	12:24

2	1:2

3	6:18

4	6:16 or 12:32

5

_____ pair of compounds illustrates the law of multiple proportion.

1	$SnCl_2$, $SnCl_4$

2	Na_2O, BaO

3	MgO, Na_2O

4	H_2O, Na_2O

6

In the given reaction, $4P + 3KOH + 3H_2O \rightarrow 3KH_2PO_2 + PH_3$

1		P is oxidised only
2		P is oxidized as well as reduced
3		P is reduced only
4		None of these

7 The sulphate of a metal has the formula $M_2(SO_4)_3$. What will be the formula for its phosphate?

1	MPO_4
2	$M_2(PO_4)_3$
3	$M_3(PO_4)_2$
4	$M(HPO_4)_2$

8 What will be the other reactant to prepare a pure sample of n-hexane using sodium metal as one reactant?

1	Ethyl bromide and n-butyl bromide
2	n-propyl bromide

3	Methyl bromide and n -pentyl chloride
4	Ethyl chloride and n-butyl chloride

9

$$CH_3-CH_2-CH_2-CH_3 \xrightarrow[HBr]{AlCl_3} Product$$. Identify the product in the above reaction.
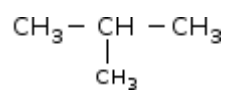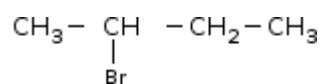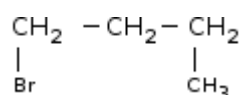
1	$CH_3- \underset{\underset{CH_3}{|}}{CH} -CH_3$
2	$CH_3- \underset{\underset{Br}{|}}{CH} -CH_2-CH_3$
3	$\underset{\underset{Br}{|}}{CH_2} -CH_2- \underset{\underset{CH_3}{|}}{CH_2}$
4	All of these

10 What is Ammonium hydroxide?

1	Weak electrolyte
2	Strong electrolyte
3	Both under different conditions
4	Non-electrolyte

11

A liquid hydrocarbon can be converted to gaseous hydrocarbon by

1   hydrolysis

2   cracking

3   oxidation

4   distillation under reduced pressure

12

In Kjeldahl's process of estimation of N, $CuSO_4$ behaves as

1   hydrolysis agent

2   catalytic agent

3   reducing agent

4   oxidising agent

13

What would be the active mass of 64 gm of HI in a two litre flask?

1	0.25
2	1
3	2
4	5

14

On complete combustion 1.4 g hydrocarbon gave 1.8 g water. What is the empirical formula of the hydrocarbon?

1	CH_4
2	CH_3
3	CH_2
4	CH

15

Hydrogen ion concentration in weak acid having dissociation constant K_a and concentration c is nearly equivalent to ____.

1	$\sqrt{K_a c}$
2	$K_a c$
3	c / K_a

4	$\sqrt{K_a/c}$

16	On which of the following, chemical equations convey quantitative information?

1	Quantity of reactant consumed and quantity of product formed
2	Relative number of moles of reactants and products involved in the reaction
3	Number of atoms/molecules of the reactants and products involved in the reaction
4	Type of atoms/molecules taking part in the reaction

17	A electrovalent compound is made up of _____.

1	electrically charged atoms or group of atoms
2	neutral atoms
3	neutral molecules
4	electrically charged molecules

18

What is the number of unpaired electrons in inert gas?

1	18
2	4
3	8
4	Zero

19

Why the reaction $CaCO_3 \rightarrow CaO + CO_2(g)$ goes to completion in lime kiln?

1	Because CO_2 escapes continuously
2	Because CaO is not dissociated
3	Because CaO is more stable than $CaCO_3$
4	Because of the high temperature

20

Name the following reaction $C_{10}H_{22} \xrightarrow{900K} C_4H_8 + C_6H_{14}$

1	Cracking
2	Alkylation

3	Pyrolysis
4	Fractionation

21

1.0 g of an oxide of A contained 0.5 g of A. 4.0 g of another oxide of A contained 1.6 g of A. Find the law indicated by the data.

1	Multiple proportions
2	Conservation of energy
3	Constant proportions
4	Reciprocal proportions

22

Preparation of ethane by the electrolysis process of aq. solution of potassium acetate is known as

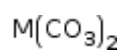| 1	Kolbe's synthesis
2	Wurtz reaction
3	Sabatier-Senderen's reaction
4	Grignard reaction

23

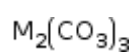MCl_3 is the molecular formula of chloride of a metal M. What would be the formula of its carbonate?

1	$M(CO_3)_2$
2	M_2CO_3
3	$M_2(CO_3)_3$
4	MCO_3
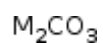
24

An organic compound with C = 40% and H = 6.7% will possess the empirical formula

1	CH_2O
2	CH_2
3	$C_2H_4O_2$
4	$C_3H_6O_3$

25
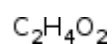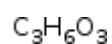
Electrolytes are the compounds that contains_____.

| 1 | hydrogen bond |

2	coordinate bond
3	covalent bond
4	electrovalent bond

---

26 Identify the redox reaction from the following.

1	Nitrogen oxides form nitrogen and oxygen by lightning
2	Evaporation of H_2O
3	In atmosphere, O_3 from O_2 by lightning
4	H_2SO_4 with $NaOH$

---

27 Find the weight of a molecule of the compound $C_{60}H_{122}$.

1	16.023×10^{23} g
2	5.025×10^{23} g
3	1.09×10^{-21} g
4	1.4×10^{-21} g

28

Find the volume occupied by one molecule of water if the density of water is 1 g cm^{-3}.

1	18 cm^3
2	6.02x10^3 cm^3
3	22400 cm^3
4	3.0x10^{-23} cm^3

29

Which of the following is the heaviest atom?

1	Pb
2	U
3	Ra
4	Hg

30

Which of the following is the strongest electrolyte?

1	$C_6H_{12}O_6$
2	NH_4OH
3	CH_3COOH
4	NaCl
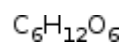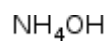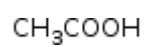
31 What happens when Fe^{2+} changes to Fe^{3+} in a reaction?

1	It gains a proton
2	It gains an electron
3	It loses a proton
4	It loses an electron

32 Cooling in refrigerator is because of

1	the expansion of the gas in the refrigerator
2	reaction of the refrigerator gas
3	expansion of ice

4	the work of the compressor

Hydrogen peroxide (H_2O_2) reduces $K_4Fe(CN)_6$ in

1	acidic solution
2	neutral solution
3	non-polar solvent
4	alkaline solution

34

Which of the following is false?

1	The presence of free ions facilitates chemical changes
2	The dissociation of weak electrolyte is a reversible reaction
3	The point of dynamic equilibrium is reached when the reaction rate in one direction just balances the reaction rate in the opposite direction
4	The greater the concentration of the substances involved in a reaction, the lower the speed of the reaction

35

Which of the following properties do not changed on descending a group in the periodic table?

1	Atomic size
2	Valence electrons
3	Density
4	Metallic character

36

An element have atomic weight 40 and it's electronic configuration is $1s^2 2s^2 2p^6 3s^2 3p^6$. Then what will be its atomic number and number of neutrons?

1	40 and 18
2	26 and 20
3	22 and 18
4	18 and 22

37

_____ relations holds good when no work is done on the system, but x amount of heat is taken out from the system and given to the surroundings.

1	$\Delta U = x$
2	$\Delta U = -x$
3	$\Delta U = \Delta E$
4	$\Delta U = -\Delta E$

---

38 The unit that represents the largest amount of energy is:

1	Calorie
2	Joule
3	Erg
4	Electron volt

---

39 In the estimation of sulphur organic compound when with concentrated HNO_3 is converted to

1	SO_3
2	H_2SO_4
3	H_2S
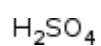
4	SO_2

40 The chemical reaction is at the equilibrium when....

1	When the rates of forward and backward reactions are equal
2	When reactants are completely transformed into products
3	When formation of products is minimized
4	When equal amounts of reactants and products are present

41 The intensive property among the following quantities is:

1	surface tension
2	mass
3	volume
4	enthalpy

42 Which of the following is the intensive quantity?

1	Temperature and refractive index
2	Enthalpy and volume
3	Volume and temperature
4	Enthalpy and temperature

43 Elements after atomic number 103 have been discovered till now. If an element with atomic no. 106 were ever discovered, the electronic configuration possessed by it will be:

1	[Rn] $5f^{14} 6d^4 7s^2$
2	[Rn] $5f^{14} 6d^6 7s^0$
3	[Rn] $5f^{14} 6d^5 7s^1$
4	[Rn] $5f^{14} 6d^1 7s^2 7p^3$

44 Chromatography is a valuable method for the separation, isolation, purification and identification of the constituents of a mixture and which is based on general principle of

1	phase operation
2	phase rule

3	phase distribution
4	interphase separation

---

45 An element forms two oxides containing 53.33 and 36.36 percent of oxygen respectively. Which law is illustrated by these figures?

1	Constant proportions
2	Conservation of mass
3	Multiple proportions
4	Reciprocal proportions

---

46 What is being oxidized in a reaction between zinc and iodine, in which zinc iodide is formed?

1	Iodine
2	Zinc atom
3	Iodide ions
4	Zinc ions

47

What is the concentration CN^- in 0.1 M HCN ? $[K_a = 4 \times 10^{-10}]$

1	$9.2 \times 10^{-6} M$
2	$6.3 \times 10^{-6} M$
3	$4.5 \times 10^{-6} M$
4	$2.5 \times 10^{-6} M$

48

Addition of a polar solvent to the solid electrolyte results in

1	electron transfer
2	ionization
3	association
4	polarization

49

Find the pairs of substances which illustrate the law of multiple proportions.

1	H_2O and D_2O

2	CO and CO_2
3	MgO and $Mg(OH)_2$
4	NaCl and NaBr

50 Which of the following are Iso-electronic species?

1	F^-, O^{+2}
2	F^-, O^+
3	F^-, O
4	F^-, O^{-2}

Botany

1 In Spirogyra meiosis take place in _____.

1	during conjugation process
2	the developing zygospore
3	during vegetative reproduction

4 during gamete formation

---

2 In which of the following meiosis takes place?

1 Pollen mother cells

2 Pollen grains

3 Pollen tube

4 Generative cells

---

3 Which of the following is present in the stroma of chloroplasts of higher plants?

1 Ribosomes

2 Light dependent reaction enzymes

3 Chlorophyll

4 Light independent reaction enzymes

---

4 How a filament of an alga is different from fungus?

1	The algae are green and fungi are non−green
2	The presence of cellulose cell wall and chlorophyllous cells in algae while chitinous cell wall and non-chlorophyllous cells in fungi
3	Chlorophyll present in algae and absent in fungi
4	Cells are uninucleate in algae whereas they are multinucleate in fungi

5 Condensation of chromosomes takes place in

1	Anaphase
2	Metaphase
3	Prophase I
4	Prophase II

6 Chloroplasts of Spirogyra contains_____.

1	wavy margin
2	smooth margin

3	smooth or wavy margin
4	none of the above

7

Find a suitable name for the process:

$$C_6H_{12}O_6 + 2ADP + 2Pi \rightarrow 2C_2H_5OH + 2ATP + 2CO_2 \uparrow$$
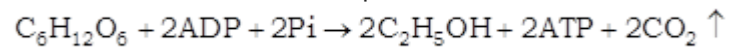
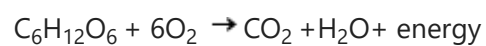| 1	Alcoholic fermentation
2	Photorespiration
3	Aerobic respiration
4	Lactate fermentation

8

Which reaction represents anaerobic respiration?

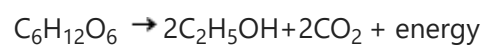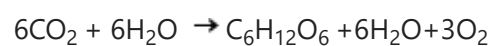| 1	$C_6H_{12}O_6 + 6O_2 \rightarrow CO_2 + H_2O + energy$
2	$6CO_2 + 6H_2 \rightarrow C_6H_{12}O_6 + 3O_2$
3	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + energy$
4	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6H_2O + 3O_2$
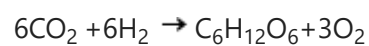
9

Protist genome consists of _____.

1   free nucleic acid aggregates

2   membrane bound nucleoproteins embedded in cytoplasm

3   nucleoprotein in direct contact with cell substance

4   gene containing nucleoproteins condensed together in loose mass

10

Increase in length of plant axis is by _____.

1   apical meristem

2   lateral meristem

3   periblem

4   dermatogen

11

The cell attaining their maximal size in terms of wall thickening and protoplasmic modification belong to which phase of growth?

1   Meristematic phase of growth

2	Maturation phase of growth
3	Elongation phase of growth
4	None of the above

12 _____ is absent in prokaryotes.

1	Endoplasmic reticulum
2	Nuclear membrane
3	Golgi bodies
4	All the above

13 Where the enzymes of TCA cycle are present?

1	Chloroplast
2	Mitochondria
3	Nucleus

4	Ribosome

14 _____ is obtained from algae.

1	Carragenin
2	Chocolate
3	Butter
4	Wax

15 _____ is a nitrogen fixer.

1	Hydrodictyon
2	Ulva
3	Anabaena
4	Ulothrix

16

Match the correct answers with type of respiration and respiratory substrates

	Respiration		Types of substrate
(A)	Floating respiration	(i)	Proteins
(B)	Cytoplasmic respiration	(ii)	Starch
(C)	Protoplasmic respiration	(iii)	Carbohydrates
(D)	Lactic acid fermentation	(iv)	Lactose

1   A-(iii) B-(ii) C-(i) D-(iv)

2   A-(ii) B-(iii) C-(iv) D-(i)

3   A-(ii) B-(iv) C-(i) D-(iii)

4   A-(i) B-(ii) C-(iii) D-(iv)

---

17   _____ is the edible part of Sweet potato.

1   Rhizome

2   Unripe fruit

3   Stem tuber

4   Adventitious root tuber

18

Many bacteria bear minute hairy structures on cell wall, these are known as _____.

1   cilia

2   pili

3   flagella

4   hairs

19

The exponential growth can be expressed as $W_1 = W_0 e^{rt}$, what is e?

1   Time of growth

2   Growth rate

3   Base of natural logarithm

4   Final size

20

The tissues provide maximum mechanical support to plant organs are

1   sclerenchyma

2   collenchyma

3	aerenchyma
4	parenchyma

---

21 Pneumatophores occurs in _____.

1	banyan
2	avicennia
3	vanda
4	mirabilis

---

22 Which of the following is not a primary meristem?

1	Endodermis
2	Procambium
3	Ground meristem
4	Protoderm

23 Robert Hooke used the term cell in which of the following year

1 1665

2 1650

3 1865

4 1960

24 What happen during the G_1 phase of cell division?

1 DNA and proteins are synthesized

2 RNA and proteins are synthesized

3 Cell prepares for M-phase

4 Cell undergoes duplication

25 Cell division cannot be stopped in _____ phase of the cycle.

1 Prophase

2	G_2-phase
3	S-phase
4	G_1-phase

---

26 Whereas number of chromosomes is reduced to half in first reduction division of meiosis, then what is need for second mitotic division?

1	For equal distribution of haploid chromosomes
2	For the segregation of replicated chromosomes
3	For the formation of four gametes
4	For equal distribution of genes on chromosomes

---

27 In a mammalian cell, which is the longest and the most active phase of the cell cycle?

1	M phase
2	G_1 phase
3	G_2 phase

4	S- phase

28 Which process is carried out by nostoc?

1	photosynthesis and nitrogen fixation simultaneously
2	only photosynthesis
3	only nitrogen fixation
4	either photosynthesis or nitrogen fixation at a time

29 Which of the following is the site of respiration in bacteria?

1	Microsome
2	Episome
3	Ribosome
4	Mesosome (cytoplasmic membrane)

30 Where does the meristems are found?

1	In Cycas stem
2	In Fern leaf
3	In Fern rhizome
4	In Pollens of Pinus

31 The most important process for the existence of life on earth is

1	Communication in animals
2	Photosynthesis by plants
3	Respiration in animals
4	Reproduction in plants and animals

32 In lactic acid fermentation, what is the number of ATP formed by the oxidation of NADH?

1	Six

2	Eight
3	Three
4	Nil

The cell theory states that _____.

1	all cells are totipotent
2	all cells have nuclei
3	cells reproduce by mitosis
4	cells are the basic structural units of living beings

_____ reactions is an example of oxidative decarboxylation.

1	Conversion of citrate to isocitrate
2	Conversion of succinate to fumarate
3	Conversion of pyruvate to acetyl CoA
4	Conversion of fumarate to malate

35 Stilt roots are recorded from

1 Pandanus

2 Bryophyllum

3 Mango-ginger

4 Radish

36 Roots help in clinging and climbing in _____.

1 hedera (Ivy) and Piper (Betel)

2 pothos and Tecoma

3 black pepper

4 all of these

37 Prop roots of Banyan tree are meant for _____.

1	respiration
2	absorption of water from soil
3	retention of water in soil
4	providing support to big tree

38 Surgical instruments are boiled in water before use because _____.

1	it provides pleasure to the patient
2	it kills the pathogens present on them
3	doctors can use them easily
4	all the saprophytes die on the operative surface

39 Mark the false statement for hydrophytes.

1	Vessels are usually absent
2	Tracheids are absent
3	Air chamber are well developed

4	Cuticle is poorly developed

40

Which is the chief water conducting elements of xylem in gymnosperms?

1	Fibres
2	Vessels
3	Transfusion tissue
4	Tracheids

41

The process of photo phosphorylation was invented by

1	Calvin
2	Arnon
3	Warburg
4	Priestley

42

_____ types of cells are known.

1. Four

2. Three

3. Two

4. One

43

In the overall process of photosynthesis, what is the total number of CO_2, water, sugar and O_2 molecules utilized and produced?

1. 31

2. 19

3. 13

4. 12

44

In purple and green bacteria, oxygen is not evolved during photosynthesis because _____ is hydrogen donor.

1. H_2O

2	H_2S
3	NH_3
4	CH_4

45

In blue-green algae, _____ is the photosynthetic product.

1	glycogen
2	normal starch
3	cyanophycean starch resembling glycogen
4	none of these

46

The significance of light and chlorophyll in photosynthesis was invented by

1	Priestley
2	Ingenhousz
3	Blackman

| 4 | Englemann |

---

47 _____ is not an effect of ethylene.

1	Breaks seed and bud dormancy
2	Promotes senescence and abscission of plant organs
3	Brings about horizontal growth of seedlings
4	Helps to overcome apical dominance.

---

48 From which of the following auxin is derived?

1	Phenylalanine
2	Tryptophan
3	Carotenoid
4	Xanthophyll

---

49 Which of the following is a natural growth hormone?

1		2, 4-D
2		Ethylene
3		NAA
4		2, 4, 5-T

---

50 Maximum growth in roots takes place

1	In presence of light
2	At apex
3	Behind the apex
4	In presence of soil

Zoology

1 Mark the true about RBCs in humans.

1	They carry about 20-25 per cent of CO_2
2	

They transport 99.5 per cent of O_2.

3	They do not carry CO_2 at all.
4	They transport about 80 per cent oxygen only and the rest 20 per cent of it is transported in dissolved state in blood plasma.

---

2 Proteins contains

1	Carbon, hydrogen, oxygen, nitrogen
2	Carbon, hydrogen, chlorine, sulphur
3	Carbon, manganese, phosphorus, nitrogen
4	Carbon, iodine, oxygen and inorganic phosphate

---

3 Purkinje cells are related with which of the following part?

1	Cerebrum
2	Cerebellum
3	Heart

| 4 | both (a) and (b) |

4

___ flows directly into blood from the seat of its production to act on an organ away from it.

1	Hormone
2	Enzyme
3	Lymph
4	Blood

5

Choose a statement regarding anal cerci and anal style is correct in cockroach.

1	Anal cerci are absent and anal styles are present in female
2	Anal cerci are absent but anal styles are present in male
3	Anal styles are absent and anal cerci are present in male
4	Anal styles are absent and anal cerci are present in female

6

In the mouth parts of cockroach the galea and lacinia form parts of _____

1	mandibles
2	maxillae
3	labrum
4	labium

7

In which of the following part, myoglobin is found?

1	Muscles
2	Blood
3	Spleen
4	Liver

8

In _____ myoglobin is present.

1	kidney
2	heart

3	muscles
4	nerve cells

9 _____ is blood clotting corpuscle.

1	Thrombocyte
2	Monocyte
3	Erythrocyte
4	Lymphocyte

10 If a certain patient with blood group B requires immediate blood transfusion, ___ and ___ type can be given to him.

1	A and AB
2	O and B
3	O and AB
4	B and AB

11

Identify the correct pair of complementary base pairs

1
Thymine-Guanine

2
Adenine-Uracil

3
Uracil-Cytosine

4
Guanine-Adenine

12

Which of the following pair is incorrect?

1
Echinodermata - Water vascular system

2
Annelida - Chloragogen cells

3
Cnidaria - Nematocyst

4
Mollusca - Pseudocoel

13

_____ is an incorrect match of the cell type and the cell wall degrading enzyme.

1
Fungus - Chitinase

2	Plant- Cellulase
3	Alga - Methylase
4	Bacteria - Lysozyme

14 _____ produces and maintains the myelin of the nerve fibres of the central nervous system.

1	Oligodendrocytes
2	Microglia
3	Astrocytes
4	None of above

15 In ATP, the high energy bond is present in ____.

1	between nucleoside and phosphate group
2	between base and phosphate group
3	between sugar and phosphate group

4	none of the above

16 The volume of air left in the lungs after forceful expiration and after normal expiration is respectively known as

1	residual volume and expiratory capacity
2	vital capacity and functional residual capacity.
3	residual volume and functional residual capacity
4	tidal volume and expiratory capacity

17 The innermost meninx surrounding the central nervous system in frog as well as in man are

1	Piamater and piamater
2	Piamater and duramater
3	Arachnoid and piamater
4	Arachanoid and duramater

18

_____ hormones is a derivative of fatty acid.

1	Thyroxine
2	Gastrin
3	Estrogen
4	Prostaglandins

19

The condition where bone marrow stops producing WBCs is termed as

1	leukaemia
2	anaemia
3	leucopenia
4	leukoplakia

20

When red blood corpuscles containing both A and B antigens are mixed with your blood serum, they agglutinate. so what is your blood group?

1	B

2	O
3	A
4	AB

---

21 Choose from the following blood cells which has a kidney shaped nucleous.

1	Eocenophil
2	Monocyte
3	Neutrophil
4	Lymphocyte

---

22 Find the correct statement with respect to kidney function regulation.

1	When someone drinks lot of water, ADH release is suppressed
2	Exposure to cold temperature stimulates ADH release
3	During summer when body loses lot of water by evaporation, the release of ADH is suppressed

4	An increase in glomerular blood flow stimulates formation of angiotensin II

23 The fusion of how many bones composes the innominate or hip bone?

1	3
2	2
3	4
4	5

24 Which of the following would most likely disrupt by the injury localised to the hypothalamus?

1	Co-ordination during locomotion
2	Short- term memory
3	Executive functions, such as decision making
4	Regulation of body temperature

25

Hamburger phenomenon is also known as:

1. Calcium shift

2. Bohr effect

3. Chloride shift

4. Sodium - Potassium pump

26

Floridean starch has structure similar to

1. Amylopectin and glycogen

2. Mannitol and algin

3. Laminarin and cellulose

4. Starch and cellulose

27

_____ sets of conditions promotes the dissociation of oxygen from haemoglobin.

1. Low $pO_2, high\, pCO_2, high\, H^+$

2	High pO_2, high pCO_2, low H^+
3	Low pO_2, low pCO_2, low H^+
4	High pO_2, low pCO_2, low H^+

---

28 _____ protein maintains the muscular storage of oxygen.

1	Actomyosin
2	Myoglobin
3	Haemoglobin
4	Myosin

---

29 Point out the correct statements.

1	During inspiration external intercostal muscles and diaphragm contract.
2	Eupnea is slow breathing.
3	Coryza is caused by human corona virus.

4   Cyanosis means collapse of alveoli.

---

30   Choose the correct option: Hormones are chemical compounds which can be

1   steroid only

2   protein only

3   carbohydrate only

4   proteins, steroids and other diphenyl amines.

---

31   ADH deficiency shows which of the following condition?

1   Polyuria

2   Polydipsia only

3   Polydipsia and polyuria

4   Glucosuria

32

Find from the following feature which is common in scorpion, dragonfly, silverfish and prawn.

1	Cephalo thorax and tracheae
2	Jointed appendages and chitinous exoskeleton
3	Chitinous cuticle and two pairs of antennae
4	Three pairs of legs and segmented body

33   Which of the following is the final product of starch digestion?

1	Glucose
2	Lactose
3	Sucrose
4	Maltose

34   Which enzyme is essential for the transport of CO_2 as bicarbonate in blood?

1	Succinic dehydrogenase
2	Carboxypeptidase

3	Carbonic anhydrase
4	Thrombokinase

35 In man, the urea is mainly formed in

1	Liver
2	Kidneys
3	Spleen
4	Gall bladder

36 Find the correct description of a certain part of a normal human skeleton.

1	Parietal bone and the temporal bone of the skull are joined fibrous joint.
2	First vertebra is axis which articulates with the occipital condyles.
3	Glenoid cavity is a depression to which the thigh bone articulates.
4	The 9th and 10th pairs of ribs are called the floating ribs.

37 Which is the most important function of diaphragm of the mammals?

1 To aid in ventilation

2 To protect lungs

3 To aid in respiration

4 To divide the body cavity into compartment

38 Osculum occurs in ____.

1 sponge

2 hydra

3 ray fish

4 star fish

39 Mark the correct statement.

1 Vasa recta is well developed in cortical nephrons

2	The juxta medullary nephrons have reduced Henle's loop
3	The PCT and DCT are situated in the medulla of the kidney
4	The ascending limb of the Henle's loop extends as the DCT

40 _____ represents the action of insulin.

1	Increases blood glucose level by stimulating glucagon production.
2	Decreases blood glucose level by forming glycogen.
3	Increases blood glucose level by hydrolysis of glycogen.
4	Increases blood glucose level by promoting cellular uptake of glucose.

41 By which hormone concentration of the urine is controlled?

1	MSH
2	ADH
3	ACTH

4	Oxytocin

42 Young one of cockroach is termed ___.

1	grub
2	naid
3	maggot
4	nymph

43 The hepatic portal vein transfer blood to liver from

1	stomach
2	intestine
3	kidneys
4	Both (a) and (b)

44 Which bactericidal protein is present in human tears?

1	Retinene
2	Lysozyme
3	Opsin
4	Transducin

---

45 In the ascending limb of the loop of Henle, what is the maximum osmotic difference that can be created by the Na-K pump?

1	400 m Osmol/L
2	300 m Osmol/L
3	200 m Osmol/L
4	100 m Osmol/L

---

46 Annedlida and mollusca resemble in many embryonic features as both have ___.

1	identical conspicuous segmentation in body, muscles and nervous system
2	spiral cleavage and mesoderm formation

3	special types of mouth parts
4	meroblastic cleavage and ectoderm formation

47 What are ovarioles?

1	Structural units of ovaries of female cockroach
2	Equivalent to uterus in function
3	The ligaments that connect ovaries to the abdominal walls
4	Structural units of gonads of male cockroach

48 _____ is not related to the autonomic nervous system.

1	Digestion
2	Peristalsis
3	Excretion
4	Memory and learning

49 Thin filament connects:

1   Myosin filaments to Z-line

2   Actin filaments to Z-line

3   Myosin filaments to M-line

4   Actin filaments to myosin filaments

50 The characteristics common in both humans and adult frogs is

1   internal fertilization

2   four chambered heart

3   nucleated RBCs

4   ureotelic mode of excretion

Physics - Answer keys

1	2
2	3
3	1

4	1
5	2
6	3
7	1
8	4
9	1
10	3
11	4
12	4
13	3
14	3
15	1
16	2
17	2
18	3
19	3
20	1
21	3
22	4
23	3
24	3
25	1
26	2
27	3
28	3
29	4

Question	Answer
30	4
31	4
32	2
33	4
34	3
35	2
36	2
37	3
38	2
39	4
40	2
41	1
42	1
43	2
44	2
45	1
46	1
47	3
48	4
49	3
50	1

Chemistry - Answer keys

Question	Answer
1	3
2	3
3	2
4	4

5	1
6	2
7	1
8	2
9	1
10	1
11	2
12	2
13	1
14	3
15	1
16	2
17	1
18	4
19	1
20	1
21	1
22	1
23	3
24	1
25	4
26	1
27	4
28	4
29	2
30	4

31	4
32	1
33	1
34	4
35	2
36	4
37	2
38	1
39	2
40	1
41	1
42	1
43	3
44	2
45	3
46	2
47	2
48	2
49	2
50	4

Botany - Answer keys

1	2
2	1
3	4
4	2
5	3

6	1
7	1
8	3
9	2
10	1
11	2
12	4
13	2
14	1
15	3
16	1
17	4
18	2
19	3
20	1
21	2
22	1
23	1
24	2
25	3
26	2
27	4
28	2
29	4
30	1
31	2

32	4
33	4
34	3
35	1
36	4
37	4
38	2
39	2
40	4
41	2
42	2
43	1
44	2
45	3
46	2
47	4
48	2
49	2
50	3

Zoology - Answer keys

1	1
2	1
3	2
4	1
5	4
6	2

7	1
8	3
9	1
10	2
11	2
12	4
13	3
14	1
15	4
16	3
17	1
18	4
19	3
20	2
21	2
22	1
23	1
24	4
25	3
26	2
27	1
28	2
29	1
30	4
31	3
32	2

Physics - Solutions

1

Here, mass of the body, $m = 0.05 \text{ kg}$

Acceleration, $a = 9.5 \text{ m s}^{-2}, g = 9.8 \text{ m s}^{-2}$

$\therefore mg - f_{air} = ma$ or $f_{air} = m(g-a) = 0.05(9.8 - 9.5) = 0.015 \text{ N}$
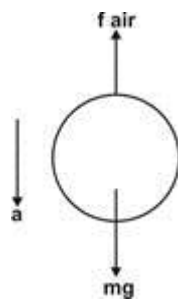
2

As per information given in the problem,

Net force on body $= \sqrt{4^2 + 3^2} = 5$ N

$\therefore a = F/m = 5/10 = 1/2$ m/s^2

and Kinetic energy $= \dfrac{1}{2}mv^2 = \dfrac{1}{2}m(at)^2 = 125$ J

3

$\tan^{-1} 2/3$

4

$e = L\dfrac{di}{dt} \Rightarrow [e] = [ML^2T^{-2}A^{-2}]\left[\dfrac{A}{T}\right]$

$[e] = \left[\dfrac{ML^2T^{-2}}{AT}\right] = [ML^2T^{-2}Q^{-1}]$

5

From the formula for Young's modulus,

$l = \dfrac{FL}{AY} \Rightarrow l \propto \dfrac{1}{r^2}$ (where, F, L and Y are constant)

$\therefore \dfrac{l_2}{l_1} = \left(\dfrac{r_1}{r_2}\right)^2 = (2)^2 = 4 \Rightarrow l_2 = 4l_1 = 4$ cm

6

$|B| = \sqrt{7^2 + (24)^2} = \sqrt{625} = 25$

Unit vector in the direction of A will be $\hat{A} = \dfrac{3\hat{i} + 4\hat{j}}{5}$

Therefore, required vector $= 25\left(\dfrac{3\hat{i} + 4\hat{j}}{5}\right) = 5(3\hat{i} + 4\hat{j}) = 15\hat{i} + 20\hat{j}$

7

From the given data in the problem,

$\dfrac{g'}{g} = \dfrac{M'}{M}\left(\dfrac{R}{R'}\right)^2 = \left(\dfrac{2M}{M}\right)\left(\dfrac{R}{2R}\right)^2 = \dfrac{1}{2}$

$\Rightarrow g' = \dfrac{g}{2} = \dfrac{9.8}{2} = 4.9$ m/s^2

8

The tension of the string, $T = m\omega^2 r$

$\Rightarrow 10 = 0.25 \times \omega^2 \times 0.1$ (Form given data)

$\Rightarrow \omega = 20$ rad/s

9

As, $PV = NKT$, $\therefore \dfrac{N_A}{N_B} = \dfrac{P_A V_A}{P_B V_B} \times \dfrac{T_B}{T_A}$

$\Rightarrow \dfrac{N_A}{N_B} = \dfrac{P \times V \times (2T)}{2P \times \dfrac{V}{4} \times T} = \dfrac{4}{1}$

10

From given, $\dfrac{Q}{t} = \dfrac{KA\Delta\theta}{l}$

$\Rightarrow 6000 = \dfrac{200 \times 0.75 \times \Delta\theta}{1}$

$\therefore \Delta\theta = \dfrac{6000 \times 1}{200 \times 0.75} = 40°C$

11

Since initially both the particles were at rest thus, velocity of centre of mass was zero and there is no external force on the system. Hence speed of centre of mass remains constant means it should be equal to zero.

12   Limiting friction

13
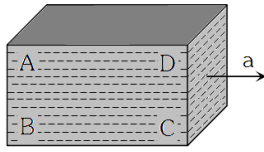
Because of acceleration towards right, there will be a pseudo force in a left direction.
Therefore the pressure will be more on rear side (Points A and B) in comparison with front side (Point D and C).
Again because of height of liquid column, pressure will be more at the bottom (points B and C) in comparison with top (point A and D).
Hence, overall maximum pressure will be at point B and minimum pressure will be at point D.

14

Given that, $v \propto g^p h^q$.
By putting the dimension of each quantity and comparing the powers in both sides, we get
$[LT^{-1}] = [LT^{-2}]^p [L]^q$
$\Rightarrow p + q = 1, \; -2p = -1, \; \therefore p = \dfrac{1}{2}, \; q = \dfrac{1}{2}$

15

Assume, initial velocity of the bullet = u

After penetrating 3 cm its velocity becomes $\dfrac{u}{2}$
We know, $v^2 = u^2 - 2as$
$\Rightarrow (\dfrac{u}{2})^2 = u^2 - 2a(3) \quad \Rightarrow 6a = \dfrac{3u^2}{4} \Rightarrow a = \dfrac{u^2}{8}$
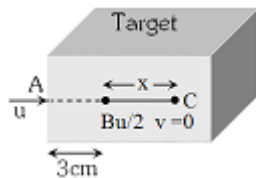
Let, further it will penetrate through distance x and stops at point C.
For distance BC, v = 0, u = u/2, s = x, a = $u^2/8$
$$v^2 = u^2 - 2as \Rightarrow 0 = (\dfrac{u}{2})^2 - 2(\dfrac{u^2}{8}).x \Rightarrow x = 1 \text{ cm}$$
Form

16

Here, the net force on stick = $F_1 - F_2 = (T_1 - T_2)l$
$\Rightarrow (0.07 €" 0.06)l = 0.01 \times 2 = 0.02$ N

17

Given: $s = \dfrac{t^2}{4}, \; \therefore \; ds = \dfrac{t}{2} dt$

and $F = ma = \dfrac{m d^2 s}{dt^2} = \dfrac{6 d^2}{dt^2}\left[\dfrac{t^2}{4}\right] = 3$ N

Now, $W = \displaystyle\int_0^2 F \, ds = \int_0^2 3\dfrac{t}{2} dt = \dfrac{3}{2}\left[\dfrac{t^2}{2}\right]_0^2 = \dfrac{3}{4}[(2)^2 - (0)^2] = 3$ J

18

Given that a person walks from his home to market with a speed of 5 km/hr. Distance = 2.5 km and time $= \dfrac{d}{v} = \dfrac{2.5}{5} = \dfrac{1}{2}$ hr and then he returns back with speed of 7.5 km/hr in rest of time of 10 minutes.

Distance $= 7.5 \times \dfrac{10}{60} = 1.25$ km

Thus, Average speed $= \dfrac{\text{Total distance}}{\text{Total time}}$

$= \dfrac{(2.5 + 1.25)\text{km}}{(40/60)\text{hr}} = \dfrac{45}{8}$ km/hr

19

Here, $l = \dfrac{FL}{AY} = \dfrac{FL^2}{(AL)Y} = \dfrac{FL^2}{VY}$

$\therefore l \propto L^2$, if volume of the wire is constant.

$\Rightarrow \dfrac{l_2}{l_1} = \left(\dfrac{L_2}{L_1}\right)^2 = \left(\dfrac{8}{2}\right)^2 = 16$

$\therefore l_2 = 16 \times l_1 = 16 \times 2 = 32$ mm $= 3.2$ cm

20

As soon as a sudden jerk is given to C, an impulsive tension exceeding the breaking tension is developed in C first which breaks before this impulse can reach A as a wave through the block.

21

From the given data in the problem, the density of the mercury is given by,

$\rho = \rho_0(1 - \gamma.\Delta\theta) = 13.6[1 - 0.18 \times 10^{-3}(473 - 273)]$

$\Rightarrow \rho = 13.6[1 - 0.036] = 13.11$ gm/cc

22

The force on the block due to acceleration of the truck will be opposite to the acceleration of truck and will be $F = ma = 1 \times 5 = 5$ N   ...(i)

While the limiting friction $f_L = \mu_s R = \mu_s mg = 0.6 \times 1 \times 10 = 6$ N

Since the applied force F is lesser than limiting friction f_L, the block will remain at rest in the truck and force of friction will be equal to applied force 5 N (not f_L) and in the direction of acceleration of the truck.

23

Boat covers distance of 16 km in a still water in 2 hours.

$\Rightarrow v_B = \dfrac{16}{2} = 8$ km/hr

Here, velocity of water $\Rightarrow v_w = 4$ km/hr.

Time taken for going upstream

$t_1 = \dfrac{8}{v_B - v_w} = \dfrac{8}{8 - 4} = 2$ hr

(As water oppose the motion of boat)

Time taken for going down stream

$t_2 = \dfrac{8}{v_B + v_w} = \dfrac{8}{8 + 4} = \dfrac{8}{12}$ hr

(As water helps the motion of boat)

$\therefore$ Total time $= t_1 + t_2 = \left(2 + \dfrac{8}{12}\right)$ hr $\Rightarrow$ 2 hr 40 min

24

As $\Delta Q = \Delta U + \Delta W \Rightarrow \Delta U = \Delta Q - \Delta W$

$\Rightarrow \Delta U = 6 \times 4.18 - 6 = 19.08$ kJ ≈ 19.1 kJ

25

Train running on a straight track

26

As we know,

$I' = \left(\dfrac{\mu}{\mu+1}\right)I = \left(\dfrac{0.25}{0.25+1}\right)I \Rightarrow \dfrac{I}{5} = 20\%$ of I.

27

By comparing given equation with standard equation,

$y = a\sin(\omega t + \phi)$, we get, $a = 2$ cm, $\omega = \dfrac{\pi}{2}$

$\therefore A_{max} = \omega^2 A$

$\Rightarrow A_{max} = \left(\dfrac{\pi}{2}\right)^2 \times 2 = \dfrac{\pi^2}{2}$ cm/s^2

28

In this problem,

Centripetal force = Breaking force

$\Rightarrow m\omega^2 r = $ Breaking stress $\times$ Cross sectional area

$\Rightarrow m\omega^2 r = p \times A$

$\Rightarrow \omega = \sqrt{\dfrac{p \times A}{mr}} = \sqrt{\dfrac{4.8 \times 10^7 \times 10^{-6}}{10 \times 0.3}}$

$\therefore \omega = 4$ rad/s

29

Here given that,

$2\pi\sqrt{\dfrac{m}{k}} = 0.6 \quad \text{.....(i)}$ and $\quad 2\pi\sqrt{\dfrac{m+m'}{k}} = 0.7 \quad \text{.....(ii)}$

Now dividing (ii) by (i), we get $\left(\dfrac{7}{6}\right)^2 = \dfrac{m+m'}{m} = \dfrac{49}{36}$

$\dfrac{m+m'}{m} - 1 = \dfrac{49}{36} - 1 \Rightarrow \dfrac{m'}{m} = \dfrac{13}{36} \Rightarrow m' = \dfrac{13m}{36}$

Also $\dfrac{k}{m} = \dfrac{4\pi^2}{(0.6)^2}$

$\therefore$ Desired extension $= \dfrac{m'g}{k} = \dfrac{13}{36} \times \dfrac{mg}{k}$

$= \dfrac{13}{36} \times 10 \times \dfrac{0.36}{4\pi^2} \approx 3.5$ cm

30

As, $F \propto xm \times (1-x)m = xm^2(1-x)$, therefore for maximum force $\dfrac{dF}{dx} = 0$.

$\Rightarrow \dfrac{dF}{dx} = m^2 - 2xm^2 = 0 \Rightarrow x = 1/2$

31

From, $S_n = u + \dfrac{a}{2}(2n-1)$

$\Rightarrow 1.2 = 0 + \dfrac{a}{2}(2 \times 6 - 1)$

$\Rightarrow a = \dfrac{1.2 \times 2}{11} = 0.218$ m/s^2

32

Work done, $W = \vec{F}.\vec{s} = (5\hat{i} + 3\hat{j}).(2\hat{i} - \hat{j})$

$\Rightarrow W = 10 - 3 = 7$ J

33

The maximum velocity for a banked road with friction,

$$v^2 = gr\left(\frac{\mu + \tan\theta}{1 - \mu \tan\theta}\right)$$

$$\Rightarrow v^2 = 9.8 \times 1000 \times \left(\frac{0.5 + 1}{1 - 0.5 \times 1}\right) \text{ (As } \mu = 0.5)$$

$$\Rightarrow v = 171.5 \approx 172 \text{ m/s}$$

34

Here we know that, stopping distance, $S \propto u^2$. Therefore if the speed is doubled, then the stopping distance will be four times.

35

Here, Force on each side = 2 TL. As two surfaces are there.

$\therefore$ Force on the frame = $4(2 \text{ TL}) = 8$ TL

36

We know that, Radius of earth R = 6400 km, $\therefore h = \dfrac{R}{4}$

Acceleration due to gravity at a height 'h',

$$g_h = g\left(\frac{R}{R+h}\right)^2 = g\left(\frac{R}{R + \frac{R}{4}}\right)^2 = \frac{16}{25}g$$

And at depth 'd' value of acceleration due to gravity,

$$g_d = \frac{1}{2}g_h \text{ (As per the problem)}$$

$$\Rightarrow g_d = \frac{1}{2}\left(\frac{16}{25}\right)g \Rightarrow g\left(1 - \frac{d}{R}\right) = \frac{1}{2}\left(\frac{16}{25}\right)g$$

Solving we get, $d = 4.3 \times 10^6$ m

37
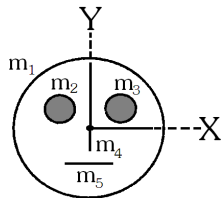
As per given in the problem,

$m_1 = 6\,m, m_2 = m_3 = m_4 = m_5 = m$

$\vec{r}_1 = 0\hat{i} + 0\hat{j}, \vec{r}_2 = -a\hat{i} + a\hat{j}, \vec{r}_3 = a\hat{i} + a\hat{j}, \vec{r}_4 = 0\hat{i} + 0\hat{j},$

and $\vec{r}_5 = 0\hat{i} - a\hat{j}$

$\therefore$ Position vector of centre of mass is given as,

$$\vec{r}_{cm} = \frac{m_1\vec{r}_1 + m_2\vec{r}_2 + m_3\vec{r}_3 + m_4\vec{r}_4 + m_5\vec{r}_5}{m_1 + m_2 + m_3 + m_4 + m_5}$$

$$\vec{r}_{cm} = \frac{0 + m(-a\hat{i} + a\hat{j}) + m(a\hat{i} + a\hat{j}) + 0 + m(-a\hat{j})}{10m} = 0\hat{i} + \frac{a}{10}\hat{j}$$

Therefore, the coordinate of centre of mass = $\left(0, \dfrac{a}{10}\right)$.

38

As soon as the spring C is stretched slowly, the tension at point A is greater than that of point C, because of the weight mg and the former reaches breaking point earlier.

39

For uniform velocity, acceleration is zero.

Since, resultant force will be zero.

$\therefore \vec{F_1} + \vec{F_2} + \vec{F_3} = 0$ or $(2\hat{i} - 5\hat{j}) + (3\hat{i} - 4\hat{j}) + \vec{F_3} = 0$ or $\vec{F_3} = (-5\hat{i} + 9\hat{j})$

40

Force, $F = Y \times A \times \dfrac{l}{L} \Rightarrow F \propto \dfrac{r^2}{L}$ (Y and I are constant)

$\therefore \dfrac{F_A}{F_B} = \left(\dfrac{r_A}{r_B}\right)^2 \times \left(\dfrac{L_B}{L_A}\right) = \left(\dfrac{2}{1}\right)^2 \times \left(\dfrac{2}{1}\right) = \dfrac{8}{1}$
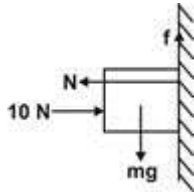
41

Because, with increase in temperature, volume of given body increases, while mass remains constant so that density will decrease.

$\Rightarrow \dfrac{\rho}{\rho_0} = \dfrac{m/V}{m/V_0} = \dfrac{V_0}{V} = \dfrac{V_0}{V_0(1 + r\Delta\theta)} = (1 - \gamma\Delta\theta)$

$\therefore \rho = \rho_0(1 - \gamma\Delta\theta)$

42

The block will the stationary as long as

$mg = f = $ force of friction $= \mu N$

$= 0.2 \times 10 = 2N \quad (\because N = 10N)$

Therefore, the weight of the block is 2 N.

43

Due to zero reaction force by satellite surface.

44

As we know, centre of mass lies always on the line that joints the two particles. Thus according to figure, for the combination ab and cd, this line does not pass through the origin. For the combination bd, initially it passes through the origin but later on it moves towards negative x-axis. But for combination ac it will always pass through origin. Thus centre of mass of this combination will remain at origin.

45

Here, Reaction on inner wheel, $R_1 = \dfrac{1}{2}M\left[g - \dfrac{v^2h}{ra}\right]$

and Reaction on outer wheel, $R_2 = \dfrac{1}{2}M\left[g + \dfrac{v^2h}{ra}\right]$

where, r = radius of circular path, 2a = distance between two wheels and h = height of centre of gravity of four-wheeler.

46

As position of centre of mass remain same in the absence of external force, therefore they will meet at their centre of mass.

47

Let Resultant of vectors $\vec{A}$ and $\vec{B}$,

$\vec{R} = \vec{A} + \vec{B} = 4\hat{i} + 3\hat{j} + 6\hat{k} - \hat{i} + 3\hat{j} - 8\hat{k}$

$\vec{R} = 3\hat{i} + 6\hat{j} - 2\hat{k}$

$\hat{R} = \dfrac{\vec{R}}{|\vec{R}|} = \dfrac{3\hat{i} + 6\hat{j} - 2\hat{k}}{\sqrt{3^2 + 6^2 + (-2)^2}} \Rightarrow \dfrac{3\hat{i} + 6\hat{j} - 2\hat{k}}{7}$

$\hat{R} = \dfrac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$

48

As $n = \dfrac{v}{\lambda} \Rightarrow n \propto v \Rightarrow \dfrac{n_{MW}}{n_{US}} \approx \dfrac{3 \times 10^8}{3 \times 10^2} \approx 10^6 : 1$

49

Joule $-$ s

50

If two liquid of equal masses with different densities are mixed together, then density of mixture is given by,

$$\rho = \dfrac{2\rho_1\rho_2}{\rho_1 + \rho_2} = \dfrac{2 \times 1 \times 2}{1 + 2} = \dfrac{4}{3}$$
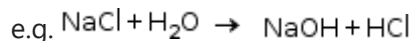
Chemistry - Solutions

1

Similar e/r ratio of the elements.

2

The solubility order is as $BeF_2 > MgF_2 > CaF_2 > SrF_2$, therefore SrF_2 is least soluble.

3

It belongs to the first group.

e.g. $NaCl + H_2O \rightarrow NaOH + HCl$

4

6:16 or 12:32

5

$SnCl_2$, $SnCl_4$

6

P is oxidized and also reduced.

7

Yet the formula of sulphate of a metal (M) is $M_2(SO_4)_3$, it is M^{3+} ion thus formula of its phosphate would be MPO_4.
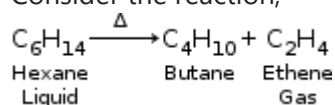
8

By the Wurtz reaction,

$2CH_3CH_2CH_2Br + 2Na \xrightarrow{\text{ether}} CH_3(CH_2)_4CH_3 + 2NaBr$

9

$CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_3$
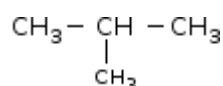
10

It is a weak electrolyte because it is slightly ionized.

11

Consider the reaction,

$\underset{\substack{\text{Hexane} \\ \text{Liquid}}}{C_6H_{14}} \xrightarrow{\Delta} \underset{\text{Butane}}{C_4H_{10}} + \underset{\substack{\text{Ethene} \\ \text{Gas}}}{C_2H_4}$

12

Catalytic agent.

13

Here, $[HI] = \dfrac{64\ gm}{128 \times 2\ litre} = 0.25$

Active mass is the concentration in moles/litre.

14

Since, 1.8 gm water obtained from 1.4 gm hydrocarbon,

∴ 18 gm water obtained from $= \dfrac{1.4}{1.8} \times 18 = 14$ gm

Now, Empirical formula Mass = 14

Therefore, Empirical formula $= CH_2$

15

$[H^+]$ in a weak acid

$[H^+] = \sqrt{K_a c}$

16

Chemical reaction quantitatively depends upon the reactant as well as product molecule

17

Electrically charged atoms or group of atoms.

18

Number of unpaired electrons in inert gas is zero as they have fully filled orbitals.

19

CO_2 escaping regularly therefore reaction proceeds in forward direction in lime kiln.
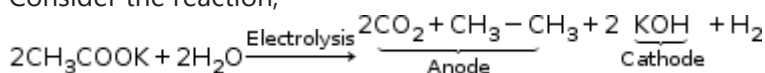
20

consider the reaction,

$$\underset{\text{Decane}}{C_{10}H_{22}} \xrightarrow[\text{Cracking}]{900\ K} \underset{\text{Butane}}{C_4H_8} + \underset{\text{Hexane}}{C_6H_{14}}$$
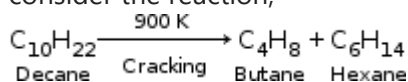
21

Multiple proportions

22

Consider the reaction,

$$2CH_3COOK + 2H_2O \xrightarrow{\text{Electrolysis}} \underset{\text{Anode}}{2CO_2 + CH_3-CH_3} + 2\ \underset{\text{Cathode}}{KOH} + H_2$$

23

Since the molecular formula of chloride of a metal M is MCl_3, it is trivalent thus formula of its carbonate will be $M_2(CO_3)_3$.
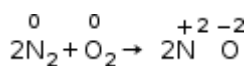
24

Element	No. of Moles	Simple ratio
C = 40%	40/12 = 3.33	1
H = 6.7%	6.7/1 = 6.7	2
O = 53.3%	5.33/16 = 3.33	1

∴ Empirical formula $= CH_2O$

25

Electrolytes are the compounds which get dissociated into their ion in water, therefore it contains electrovalent bond.

26

$$\overset{0}{2N_2} + \overset{0}{O_2} \rightarrow \overset{+2\ -2}{2N\ O}$$

Here oxidation no. of N increases from O in N_2 to +2 in NO, 2- and that of decreased from O in O_2 to -2 in O, so it is a redox reaction.

27

Here, Molecular weight of $C_{60}H_{122}$ = 12x60 + 122x1 = 720 + 122 = 842

As, 6×10^{23} molecule $C_{60}H_{122}$ has mass = 842 gm

∴1 molecule $C_{60}H_{122}$ has mass $\dfrac{842}{6 \times 10^{23}}$ = 140.333x10^{-23} gm = 1.4x10^{-21} gm

28

Here, $d = \dfrac{M}{V}$; $1 = \dfrac{M}{V}$ or M = V; 18 gm = 18 ml

As, 6×10^{23} molecule of water has volume = 18 cc

∴1 molecule of water has volume $= \dfrac{18}{6 \times 10^{23}}$ = 3.0x10^{-23} cm^3

29

U > Ra > Pb > Hg. Heaviest atom is U.

30
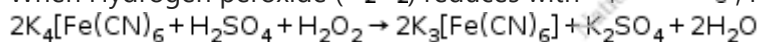
As Sodium chloride is a salt, it is a strong electrolyte.

31

$Fe^{2+} \rightarrow Fe^{3+} + e^-$ is the oxidation process.

32

This is according to Joule-Thomson effect

33

When Hydrogen peroxide (H_2O_2) reduces with $K_4[Fe(CN)_6]$, it is present in acidic solution.
$2K_4[Fe(CN)_6] + H_2SO_4 + H_2O_2 \rightarrow 2K_3[Fe(CN)_6] + K_2SO_4 + 2H_2O$

34

When we increase the concentration of substance, then speed of the reaction increases

35

Valence electrons

36

Here, Ar^{40}_{18} = Atomic number 18 and no. of Neutron in case of Ar_{22}
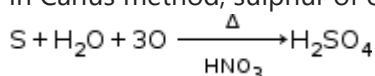Neutron = Atomic mass - Atomic number = 40 - 18 = 22.

37

$\Delta U = -x$

38

Calorie

39

In Carius method, sulphur of organic compound is converted to H_2SO_4 as given below,
$$S + H_2O + 3O \xrightarrow[HNO_3]{\Delta} H_2SO_4$$

40

When the rates of forward and backward reactions are equal.

41

Surface tension is an intensive property which is independent of the quantity of matter present in the system.

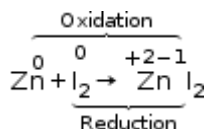| 42	Temperature and refractive index
43	[Rn] $5f^{14}\,6d^5 7s^1$
44	Phase rule
45	Multiple proportions

46

$$\overset{\text{Oxidation}}{\overline{\underset{\text{Reduction}}{\underline{\overset{0}{Zn}+\overset{0}{I_2}\rightarrow \overset{+2}{Zn}\overset{-1}{I_2}}}}}$$

From the above reaction Zn atom is oxidized to Zn^{2+} ion and iodine is reduced to I^-.

47	$6.3\times10^{-6}\,M$
48	Polar solvent facilitate ionization of strong electrolytes because of dipole-ion attraction.
49	CO and CO_2
50	F^-, O^{-2}

Botany - Solutions

1   Meiosis is known as zygotic meiosis.

2   As pollen grain formed from pollen mother cells by meiosis.

3   Stroma of chloroplasts of higher plants contain light independent reaction enzymes. The dark reactions of photosynthesis is purely enzymatic and slower than the primary photochemical reaction. It takes place in stroma portion of the chloroplast and is independent of light i.e., it can occur either in presence or in absence of light provided that assimilatory power is available.

4   The presence of cellulose cell wall and chlorophyllous cells in algae while chitinous cell wall and non-chlorophyllous cells in fungi.

5   The condensation of chromosomes takes place in the prophase−I.
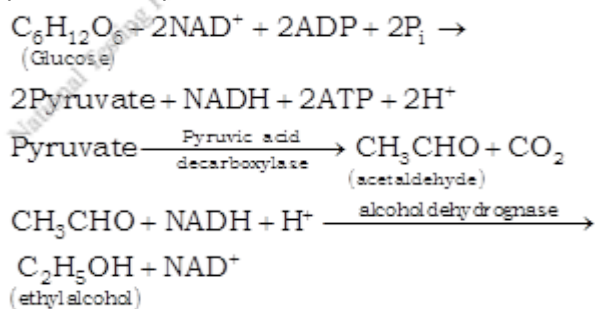
6   Some ribbon (spiral) shaped chloroplast (wavy margin) with pyrenoids and large central vacuole

7   Alcoholic fermentation consist of a series of biochemical reactions in which pyruvate (the end product of glycolysis) is converted to ethanol and carbon dioxide. It is the basis of the baking

and brewing industries. In this process, sugar $(C_6H_{12}O_6)$ first breaks into pyruvate (by the process of glycolysis), which is then converted to ethanol (C_2H_5OH) and CO_2. The whole process is expressed as :

$$C_6H_{12}O_6 + 2NAD^+ + 2ADP + 2P_i \rightarrow$$
(Glucose)

$$2Pyruvate + NADH + 2ATP + 2H^+$$

$$Pyruvate \xrightarrow[\text{decarboxylase}]{\text{Pyruvic acid}} CH_3CHO + CO_2$$
(acetaldehyde)

$$CH_3CHO + NADH + H^+ \xrightarrow{\text{alcohol dehydrogenase}}$$

$$C_2H_5OH + NAD^+$$
(ethyl alcohol)

8

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 +$ energy

9

Membrane bound nucleoproteins embedded in cytoplasm

10

These cells divide in different planes. Also, these are responsible for increase in length.

11

The period of growth in plants is catagorises into 3 phases - meristematic, elongation and maturation. Further away from apex, more proximal to the phase of elongation, lies the portion of axis undergoing the phase of maturation and the cells in this zone attain their maximal size in terms of wall thickening and protoplasmic modification. The cells in the phase of maturation undergo structural and physiological differentiation to attain a particular shape, size, thickening, internal constitution and a particular function.

12

All the above

13

The Krebs' cycle is also called as citric acid cycle of tricarboxylic acid (TCA) cycle after the initial product. Krebs' cycle is stepwise oxidative and cyclic degradation of activated acetate derived from pyruvate and it occurs inside matrix of mitochondria as enzymes of TCA cycle are present in mitochondria.

14

Carragenin is obtained from chondrus. It is member of Rhodophyceae.

15

Anabaena

16

A-(iii) B-(ii) C-(i) D-(iv)

17

Adventitious roots store food material, therefore it is edible part of sweet potato.

18

Pili

19

Growth is mainly dependent on three factors - initial size of population (W_0), rate of growth (r) and the time interval for which the rate of growth can be retained respectivelly.

$$W_1 = W_0 e^{rt}$$

Here, W_1 is the final size, W_0 is initial size, r is growth rate, it is time to growth while e is the base of natural logarithm (2.71828). The magnitude of r or rate of growth has been termed as efficiency index by Blackman (1919) as the organs and organisms with higher value will outperform others with low r value.

20 Sclerenchyma tissues provide maximum mechanical support to plant organs, which consists of long, narrow cells with thick and lignified cells walls having a few or numerous pits. They are usually dead and without protoplasts.

21 Avicennia

22 Endodermis is consist of permanent tissue.

23 1665

24 RNA and proteins are synthesized

25 Cell cycle comprises of four phases G_1, S, G_2 and M phase. The first check point is present at the end of cell cycle€™s G_1 phase, just before entry S phase, making the key decision of whether the cell should divide, delay division or enter a resulting stage. Many cells stop at this stage and enter G_0 (resting stage) and the second check point is present at the end of G_2 phase, triggering the start of M phase (mitosis). Cell cycle is arrested at this phase if it sees any DNA damage. The third checkpoint located at metaphase (spindle checkpoint). The mitotic spindle check point occurs at the point in metaphase where all the chromosomes should have aligned at the mitotic plate and be under bipolar tension and this is sensed and initiates anaphase entry. The sensing allows degradation of cyclin B, which ensures that it no longer inhibits the anaphase promoting complex, and thus cycle continues. Therefore, cell division cannot be stopped in S phase of the cell cycle.

26 Reduction of DNA content does not occur in meiosis-I. Truely haploid nuclei in terms of DNA contents as well as chromosomes number are made in meiosis-II. When chromatids of each chromosome are separated in to different nuclei. Therefore, meiosis-II is necessary.

27 For a mammalian cell growing in culture with a generation time of 16 hours , the different phases with their time periods would be as follows : G_1 =5 hours, S=7 hours, G_2 =3 hours, and mitosis =1 hour.
Therefore, S phase is longest phase in a mammalian cell division. It is also the most active phase. In synthetic phase the chromosomes replicate. The DNA content doubles and duplicate set of genes are formed. Alongwith replication of DNAs, new chromatin fibres are formed which, remain attached in pairs and the number of chromosomes does not increase. Subunits of kinetochores are also synthesised.

28 As they have photosynthetic lamellae for photosynthesis and heterocyst for N_2-fixation.

29 In bacteria, the cytoplasm of outer membrane forms much coiled invaginations known as mesosomes which participates in aerobic respiration of bacteria.

30 Cycas stem

31 Photosynthesis by plants is most vital process for the existence of life on earth as photosynthesis helps to maintain the equilibrium position of O_2 and CO_2 in the atmosphere. It purifies the air and synthesize foods for all living beings.

32 In Lactic acid fermentation, ATP formation is nil. In Lactic acid fermentation pyruvic acid produced in glycolysis is directly reduced by NADH to form lactic acid. CO_2 is not produced.

$$\text{Pyruvic acid} + NADH \xrightarrow[\text{FMN,Zn}^{2+}]{\text{Lactic dehydrogenase}}$$

$$Lactic\,acid + NAD^+$$
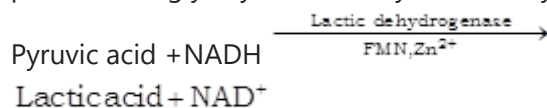
ATP formation does not occur during regeneration of NAD^+.

33 Cells are known as the basic structural units of living beings

34 Oxidative decarboxylation is the link reaction or gateway step as it links glycolysis with Krebs€™ cycle and pyruvate which is formed in cytoplasm by glycolysis produce $CO_2, NADH_2$ and acetyl CoA by oxidative decarboxylation reaction. Acetyl CoA functions as substrate entrant for Krebs€™ cycle.

35 In some plants, roots arise from lower nodes of stem and enter the soil to provide extra support. They behave as ropes of a tent. Such roots are called as stilt or brace roots e.g. Pandanus.

36 All of these

37 Prop or pillar or columnar roots are pillar-like roots which give extra mechanical support to heavy stem branches e.g. Banyan tree.

38 Sterilization of surgical instrument is required to check the infection.

39 In roots of hydrophytes, cuticle is either absolutely absent or, if present it is poorly developed. Epidermis is usually single-layered made up of thin-walled Parenchymatous cells. Cortex is well developed thin-walled and Parenchymatous, major portion of which is occupied by well developed prominent air cavities -the ' aerenchyma' which offers resistance to bending stress, increases buoyancy and allows a rapid gaseous exchange. Vascular tissues are also poorly developed. In xylem, vessels are less common and tracheids being generally present.

40 The chief water conducting elements of xylem in gymnosperms are tracheids. It is elongated cells with tapering ends and are dead due to depositions of lignin. These show scalariform,

annular, reticulate or bordered pitted thickening and are the only water conducting xylem elements in both gymnosperms and Pteridophytes. Generally vessels are absent in gymnosperms with exceptions such as Gnetum, Welwitschia, Ephedra.

41 Arnon etal. (1954) first of all demonstrated that isolated chloroplasts can produce ATP from ADP+ip. They named this ATP production as photo phosphorylation.

42 In present time three types of cells are known which are prokaryotic, mesokaryotic and eukaryotic.

43 The equation of photosynthesis is $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6H_2O + 6O_2$

NO. of CO_2 molecules utilized =6

No. of H_2O molecules utilized = 12

No. of $C_6H_{12}O_6$ (sugar) molecules produced =1

No. of H_2O molecules produced = 6

No. of O_2 molecules produced = 6

So, total number of CO_2, H_2O, O_2 and sugar utilized and produced = 6 +12 + 1 + 6 + 6=31.

44 Purple and green bacteria are photoautotrophic bacteria that produces bacteriochlorophyll and bacteriophaeophytin as photosynthetic pigments. These bacteria perform anoxygenic photosynthesis i.e. no oxygen is evolved during photosynthesis. It is due to the fact that water is not used as a source of reducing power, instead hydrogen is obtained either directly (some purple bacteria) or from various types of inorganic and organic compounds, i.e., H_2S (green bacteria).

45 Cyanophycean starch resembling glycogen

46 According to Jan Ingen-Housz (1779), both green parts as well as sunlight are required for air purification and plant nourishment.

47 Ethylene is a simple gaseous plant hormone. It produced in large amounts by senescing organs and ripening fruits. It promotes abscission and senescence, fruit ripening, horizontal growth of seedlings, bud openings and seed germination but do not overcome apical dominance. It help to overcome apical dominance.

48 Auxin is plant growth hormone responsible for such processes as the promotion of growth by cell enlargement, the maintenance of apical dominance, and the initiation of root formation in cuttings. Naturally occurring auxins, principally indoleacetic acid (IAA) is true natural auxin of plants and tryptophan is its precursor.

49 Ethylene is a natural growth hormone i.e. it is produced in plants from the amino acid methionine. It is formed naturally in all parts of plants like roots, leaves, flower, fruits and seeds. Maximum synthesis of ethylene occurs during climacteric ripening of fruits and tissues undergoing senescence. Excess of auxin also induces ethylene synthesis.

50

Apex portion of root is made up of protective tissue 'root cap' as well as region of cell division is situated below the root cap.

Zoology - Solutions

1

Blood is the transport medium of $O_2 \text{ and } CO_2$. About 97% of O_2 is transported by RBCs in the blood and the remaining 3% of O_2 is carried in a dissolved state through the plasma. Nearly 20-25% of CO_2 is transported by RBCs whereas 70% of it is carried as bicarbonate. About 7% of CO_2 is carried in dissolved state through plasma.

2

Carbon, hydrogen, oxygen, nitrogen

3

Purkinje cells are related to cerebellum. They are the large flask shaped cells present in the middle layer of the cerebellum. The Purkinje cells rank among the most complex of all neurons. These are multipolar neurons having large bodies from which arise several dendrons with highly branched dendrites, which form a flat fan extending towards the surface of the cerebellum.

4

Hormone

5

Anal styles are absent and anal cerci are present in female

6

Maxillae lie beneath mandibles and articulate with the posterior surface of head capsule, one on either side and they are biramous in structure in structure. The basal part of protopodite consists of a distal cylindrical stipes hinged to a proximal basal cardo at an obtuse angle. Stipes bears three processes : (i) inner lacinia which is sclerotized with a pair of sharp denticles and blunt lacinula, (ii) middle galea which acts as a hood for lacinia and (iii) outer long maxillary palp, which is 5- segmented and sensory in nature.

7

Muscles contain their own oxygen-carrying iron-protein pigment myoglobin or muscle haemoglobin.

8

Myoglobin is present in muscles. Myoglobin is an iron containing globular protein resembling haemoglobin. It comprises a single polypeptide chain and a haem group (like haemoglobin) which reversibly with oxygen, hence it acts as an oxygen reservoir within the muscles fibres and provides oxygen when muscle oxygen demand outpaces supply from the blood, e.g., during strenuous exercise.

9

Platelet (thrombocyte) is a minute disc-shaped cell fragment in mammalian blood and they are formed as fragments of larger cells (megakaryocytes) found in red bone marrow; they have no nucleus. They play an important role in blood clotting and release serotonin, thromboplastin and other chemicals that cause a chain of events leading to the formation of

a plug at the site of the damage, thus preventing further blood loss. There are about 250,000 platelets per cubic millimeter of blood.

10 O and B

11 Adenine-Uracil

12 Molluscs are true coelomates

13 Plant cell wall mainly consist of cellulose and so can be degraded by cellulase enzyme. Fungal cell wall consist of chitin and so can be degraded by chitinase enzyme. Bacterial cell wall mainly comprises of peptidoglycans and can be degraded by lysozyme (or muramidase). Cell wall of algae mainly contains cellulose besides other phycocolloids. It cannot be degraded by methylase enzyme.

14 oligodendrocytes

15 None of the above

16 The volume of air left in the lungs after forceful expiration and after normal expiration is respectively known as residual volume and functional residual capacity. It is about 1100mL to 1200mL. Volume of air that will remain in the lungs after a normal expiration is known as functional residual capacity. This includes residual volume and the expiratory reserve volume (RV+ERV).

17 Piamater and piamater

18 Thyroxine is an iodine containing (65% iodine) hormone, derived from amino acid tyrosine. Gastrin is a peptide hormone and estrogen is a steroid hormone and the prostaglandins are a group of hormones like lipid compounds that are derived enzymatically from fatty acids and have important functions in animal body such as regulating the contraction and relaxation of smooth muscles.

19 Leucopenia (or leukocytopenia) is a condition in which number of white blood cells (leucocytes) decreases in our body. White blood cells are constantly produced in the bone marrow. Under specific conditions, bone marrow may stop producing WBCs which results in low WBC count and makes the person susceptible to various infections such as viral or bacterial infections.

20 The agglutination occurs between a compatible antigen and an antibody. Agglutination of blood cells results in the clumping of them. Here, AB blood antigens are mixed with unknown blood sample that resulted into agglutination and this is possible when AB antigens react with their specific antibodies i.e., anti-a and anti-b. Blood group O is without A and B antigens on the blood cells but have antibodies for both these antigens in the plasma.

Therefore, the unknown blood sample which was mixed with AB blood group is O in blood group.

21 Monocyte

22 Antidiuretic hormone (ADH) or Vasopressin increases the reabsorption of water in the distal convoluted tubule, collecting tubules and collecting ducts of the nephrons of the kidneys. In resilts in the reabsorption of water from the glomerular filtrate is increased. When someone drinks lot of water, requirement of absorption of water decreases, so ADH release is suppressed.

23 Hip bone is formed by the fusion of three bones; ilium on upper side, pubis on inner side while ischium below the pubis.

24 Hypothalamus present at the base of the thalamus. It provides anatomical connection between the nervous and endocrine systems by its relationship to the pituitary gland. Hypothalamus is thermoregulatory centre. So, it is called €œthermostat€ of the body. It keeps body temperature at roughly $37^0 C$ by means of a complex thermostat system. Any localised injury to hypothalamus will, so, disrupt regulation of body temperature.

25 NA

26 Amylopectin and glycogen

27 Shift of oxygen hemoglobin dissociation curve to right indicates dissociation of oxygen from haemoglobin. The oxygen-haemoglobin curve is shifted to right in the certain conditions given as: (i) Decrease the partial pressure of oxygen. (ii) Increase in partial pressure of carbon dioxide (Bohr effect). (iii) Increase in hydrogen ion concentration and decrease in pH (acidity). (iv)Increased body temperature (v) Excess of 2, 3 diphosphoglycerate (DPG).

28 The sarcoplasm also consists of a protein pigment myoglobin, which can take up store or give up oxygen like haemoglobin.

29 During inspiration external intercostal muscles and diaphragm contract is the correc statement. Inspiration is a process by which fresh air enters the lungs. The diaphragm, intercostal muscles and abdominal muscles play an important role in this process. The diaphragm becomes flat and gets lowered by the contraction of its muscle fibres thereby increases the volume of the thoracic cavity in length and external intercostal muscles occur between ribs. These muscles contract and pull the ribs and sternum upward and outward thus increasing the volume of the thoracic cavity. The abdominal muscles play a passive role in inspiration. These muscles relax and allow compression of abdominal organs by the diaphragm.

30 Hormones are chemical messengers produced by the ductless glands and transported in the circulation to target cells which regulate metabolic process, i.e., all the chemical and energy transformation that occur in the body. Chemically hormones are of different nature like

biogenic amines (thyroxine, adrenaline, etc.), proteinaceous or polypeptide (hypothalamic hormones, epinephrine etc.) and steroids (like sex hormones and adrenocorticoids).

31 Antidiuretic hormone (ADH) deficiency leads to the syndrome of diabetes insipidus: inability to concentrate the urine, leading to polyuria (production of large amounts of clear urine) which is responsible for dehydration and in compensation-extreme thirst and constant need to drink (polydipsia).

32 Jointed appendages and chitinous exoskeleton

33 Glucose

34 Carbonic anhydrase enzyme is essential for the transport of CO_2 as bicarbonate in blood.

The large fraction of carbon dioxide (about 70%) is converted to bicarbonate ions $\left(HCO_3^-\right)$ and transported in plasma. When carbon dioxide diffuses into the RBCs, it combines with water, forming carbonic acid $\left(H_2CO_3\right)$. H_2CO_3 is unstable and quickly dissociates into hydrogen ions and bicarbonate ions.

$$CO_2 + H_2O \underset{\text{Carbonic anhydrase}}{\rightleftharpoons} H_2CO_3$$
$$\rightleftharpoons H^+ + HCO_3$$
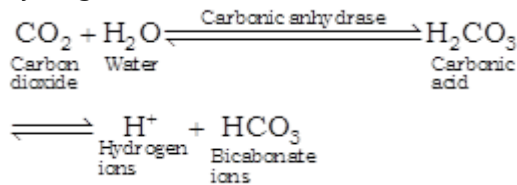
This reaction is thousands times faster in erythrocytes as they contain carbonic anhydrase, an enzyme that reversibly catalyses the conversion of carbon dioxide and water to carbonic acid.

35 Ornithine cycle is a cyclic process of urea formation that operates in the mitochondria of liver cells and has been studied by Krebs and Henseleit.

36 The bones of skulls are joined by white fibrous tissue that sustain no movement between the skull bones. This kind of joint is classified as fibrous or immovable joints.
Therefore, parietal and temporal bone of the skull are joined by fibrous joints. First cervical vertebra, atlas, joins the second cervical vertebra axis to form a joint (pivot joint) which allows movements in one plane. The atlas supports the head and allows movements of head over neck. The last two pairs of ribs are of ribs are known as floating ribs because their anterior ends are not attached to either the sternum or the cartilage of anterior rib.

37 To aid in ventilation

38 Sponges have numerous mouth lets (ostia) and one exit (osculum).

39 The ascending limb of the Henle's loop extends as the DCT is correct statement. The thick segment of the ascending limb of Henle's loop opens into the DCT lying in the cortex. The juxta medullary nephrons have long loops of Henle and cortical nephrons do not have vasa recta. PCT and DCT are situated in the cortex of the kidney.

40

Insulin decreases the level of glucose in the blood and it acts by stimulating liver cells and muscle cells to take up glucose from the blood and convert it into glycogen. When the blood sugar level drops, the secretion of insulin is suppressed on the other hand when the blood sugar level rises, the secretion of insulin is stimulated.

41

ADH (antidiuretic hormone or vasopressin or pitressin) secreted by posterior lobe of pituitary gland increases the reabsorption of water in the distal convoluted tubule and collecting ducts of the nephrons of kidney. Due to this, water reabsorption from glomerular filtrate is increased and urine becomes concentrated.

42

Nymph

43

Blood enters the liver from two sources. From the hepatic artery, it gets oxygenated blood and from the hepatic portal vein, it receives deoxygenated blood. Blood in the hepatic artery comes from the aorta and blood in the hepatic portal vein comes directly from the intestine (containing newly absorbed nutrients), stomach, etc.

44

Lysozyme is an antibacterial enzyme distributed in body fluids and secretions, including tears and saliva. It disrupts the polysaccharide components of bacterial cell walls, leaving them susceptible to destruction.

45

The thick part of the ascending loop of Henle is virtually impermeable to water, but large amounts of sodium, potassium, chloride, and other ions are actively transported from the tubule into the medullary interstitium. Thus, fluid in the thick ascending limb of the loop of Henle becomes very dilute, falling to a concentration of about 100 m Osmol./l.

46

Identical conspicuous segmentation in body, muscles and nervous system

47

Ovarioles are structural units of ovaries of female cockroach. In female cockroach, there are two ovaries, one on either side of the alimentary canal. Each ovary consists of eight ovarioles or ovarian tubules that produce ova. All the filaments of the eight ovarioles of each ovary are united to form a ligament and the ligaments of both ovaries meet in the middle line and get attached to the fat bodies. Ovarioles pass the ova to the oviduct.

48

Memory and learning is not related to the autonomic nervous system. Autonomic nervous system is the part of the peripheral nervous system responsible for the control of involuntary muscles (e.g., the heart, bladder, bowels) and so those bodily functions that are not consciously directed, including regular beating of the heart, intestinal movements, sweating, salivation, etc.

49

Myosin filaments to Z-line

50

Excretion of urea is called as ureotelism and the animals which excrete urea are called ureotelic. Ureotelic animals include Ascaris, earthworm (both are ammonotelic and ureotelic),

cartilaginous fishes like sharks and sting rays, semi-aquatic amphibians such as frogs and toads, aquatic or semi-aquatic reptiles like turtles, terrapins and alligators, and man and all other mammals. Urea is less soluble and less toxic in water than ammonia. So, it can stay for some time in the body. Amphibian tadpole (e.g., tadpole of frog) excrete ammonia but after metamorphosis frog excretes urea.