Physics

1. Name the energy which an e⁻ acquires, when accelerated through a potential difference of 1 volt.

1	1 Watt
2	1 Erg
3	1 Electron volt
4	1 Joule

2. What will be unit vector parallel to the resultant of vectors $\vec{A} = 4\hat{i} - 3\hat{j}$ and $\vec{B} = 8\hat{i} + 8\hat{j}$?

1	$\dfrac{6\hat{i} + 5\hat{j}}{13}$
2	$\dfrac{24\hat{i} + 5\hat{j}}{13}$
3	$\dfrac{12\hat{i} + 5\hat{j}}{13}$
4	None of these

3

The pressure at the bottom of a tank containing a liquid does not depend on which factor?

1	Nature of the liquid
2	Area of the bottom surface
3	Height of the liquid column
4	Acceleration due to gravity

4

Let D is the distance of the centres of moon as well as earth and the mass of earth is 81 times the mass of the moon. Then determine the distance from the centre of the earth at which the gravitational force will be zero.

1	$\dfrac{2D}{3}$
2	$\dfrac{5D}{3}$
3	$\dfrac{9D}{10}$
4	$\dfrac{D}{2}$

5

One car moving on a straight road covers $\dfrac{1}{3}$rd of the distance with 20 km/hr and the rest with 60 km/hr. What is the average speed of the car?

1	36 km/hr
2	40 km/hr
3	60 km/hr
4	80 km/hr

6 A particle describes a horizontal circle in a conical funnel whose inner surface is smooth with speed of 0.5 m/s. What is the height of the plane of circle from vertex of the funnel?

1	0.25 cm
2	2 cm
3	2.5 cm
4	4 cm

7 A girl walks to her school at a distance of 6 km with constant speed of 2.5 km/hr and walks back with a constant speed of 4 km/hr. Find her average speed for round trip expressed in km/hr.

1	4

2	1/2
3	24/13
4	40/13

8

If a particle of mass 'm' is moving in a horizontal circle of radius 'r' with a centripetal force (-k/r²), then find the total energy.

1	$-\dfrac{k}{r}$
2	$-\dfrac{2k}{r}$
3	$-\dfrac{k}{2r}$
4	$-\dfrac{4k}{r}$

9

If the time period 'T' of vibration of a liquid drop depends on surface tension 'S', radius 'r' of the drop and density 'ρ' of the liquid, then what is the expression of T?

1	$T = k\sqrt{\rho r^3/S^{1/2}}$
2	$T = k\sqrt{\rho r^3/S}$
3	$T = k\sqrt{\rho^{1/2}r^3/S}$

4	None of these

10 Position of a particle in a rectangular co-ordinate system is (3, 2, 5). Then its position vector will be

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

11 A force of 5 N acts on a 15 kg body initially at rest. Find the work done by the force during the first second of motion of the body.

1	75 J
2	6 J
3	5 J
4	$\dfrac{5}{6}$ J

12

A constant pressure air thermometer gave a reading of 47.5 units of volume when immersed in ice cold water, and 67 units in a boiling liquid. Calculate the boiling point of the liquid.

1	100°C

2	112°C

3	125°C

4	135°C

13

A block of mass 2 kg rests on a horizontal surface. If a horizontal force of 5 N is applied on the block, what is the frictional force on it? $(\mu_k = 0.4, \mu_s = 0.5)$

1	5 N

2	8 N

3	10 N

4	0

14

1 mole of gas occupies a volume of 100 ml at 50 mm pressure. How much volume is occupied by 2 moles of gas at 100 mm pressure and at same temperature?

1	500 ml
2	200 ml
3	100 ml
4	50 ml

---

15 A ball of mass 'm' moves with speed 'v' and strikes a wall having infinite mass and it returns with same speed, then find the work done by the ball on the wall.

1	v/m J
2	m/v J
3	mv J
4	Zero

---

16 A drunkard is walking along a straight road. He takes 5 steps forward and 3 steps backward followed again by 5 steps forward and 3 steps backward and so on. Each step is one metre long and takes one second. There is a pit on the road 11 metre away from the starting point. The drunkard will fall into the pit after how much time?

1	41 s

2	31 s
3	29 s
4	21 s

---

17 Inertia is the property of a body, which makes it unable to change by _____.

1	itself the state of rest
2	itself the direction of motion
3	itself the state of uniform motion
4	itself the state of rest and of uniform linear motion

---

18 Two masses 'M' and 'm' are attached to a vertical axis by weightless threads of combined length 'l'. They are set in rotational motion in a horizontal plane about this axis with constant angular velocity 'ω'. If the tensions in the threads are same during motion, then what is the distance of M from the axis?

1	$\dfrac{Ml}{M-m}$
2	$\dfrac{M-m}{M}l$
3	

$$\frac{ml}{M+m}$$

4	$\dfrac{M+m}{m}l$

19

If a particle comes round a circle of radius 1 m once and the time taken by it is 10 s, then what is the average velocity of motion?

1	Zero

2	0.2 πm/s

3	2 m/s

4	2 πm/s

20

What is the magnitude of a given vector with end points (4,-4,0) and (-2,-2,0)?

1	$5\sqrt{2}$

2	$2\sqrt{10}$

3	6

4	4

21

A person sitting on the topmost berth in the compartment of a train which is just going to stop on a railway station, drops an apple aiming at the open hand of his brother sitting vertically below his hands at a distance of about 2 meter. Determine the situation of the apple fall.

1 The apple will fall precisely on the hand of his brother

2 The apple will fall slightly away from the hand of his brother in the direction opposite to the direction of motion of the train

3 The apple will fall slightly away from the hand of his brother in the direction of motion of the train

4 None of the above

22

A particle executing SHM covers a distance equal to half its amplitude in 1 second. What is the time period of the particle?

1 12 s

2 8 s

3 6 s

4 4 s

23

For ____, $Erg-m^{-1}$ can be the unit of measure.

1	power
2	acceleration
3	force
4	momentum

24

Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m. What is the reaction of the 6th coin (counted from the bottom) on the 7th coin?

1	4mg
2	3mg
3	7mg
4	6mg

25

A uniform chain of length 'L' changes partly from a table which is kept in equilibrium by friction. The maximum length that can withstand without slipping is 'l', then what is the coefficient of friction between the table and the chain?

1	$\dfrac{l}{L}$

2	$\dfrac{I}{L-I}$
3	$\dfrac{I}{L+I}$
4	$\dfrac{L}{L+I}$

26

The centre of mass of three particles 10 kg, 20 kg and 30 kg is at (0,0,0). Determine the position of a particle of mass 40 kg where it should be placed so that the combination centre of mass will be at (3,3,3).

1	(0, 0, 0)
2	(1, 2, 3)
3	(4, 4, 4)
4	(7.5, 7.5, 7.5)

27

Consider a copper rod of length 10 cm and area of cross-section 100 cm^2 through which a heat flux of 4000 J/s is to be passed. The thermal conductivity of copper is 400 W/m °C. At which temperature difference, the two ends of this rod must be kept?

1	1000°C
2	100°C

3	10°C
4	1°C

---

28 Determine the temperature at which the surface tension of water is zero?

1	0°C
2	370°C
3	Slightly less than 647 K
4	Both (2) and (3)

---

29 Thermoelectric thermometer is based on which of the following?

1	Compton effect
2	Photoelectric effect
3	Seebeck effect
4	Joule effect

30

1 femtometer is equivalent to:

1	10^{12} m
2	10^{15} m
3	10^{-12} m
4	10^{-15} m

31

If two objects of masses 200 g and 500 g have velocities $10\hat{i}$ m/s and $3\hat{i} + 5\hat{j}$ m/s respectively. Then what is the velocity of their centre of mass in m/s?

1	$25\hat{i} - \dfrac{5}{7}\hat{j}$
2	$5\hat{i} + \dfrac{25}{7}\hat{j}$
3	$\dfrac{5}{7}\hat{i} - 25\hat{j}$
4	$5\hat{i} - 25\hat{j}$

32

On applying a stress of 20 x 10^8 N/m² the length of a perfectly elastic wire is doubled. Then find its Young's modulus.

1	5 x 10^8 N/m²

2	10×10^8 N/m^2
3	20×10^8 N/m^2
4	40×10^8 N/m^2

---

33 Determine the scalar quantity amongst the following:

1	Acceleration
2	Displacement
3	Work
4	Electric field

---

34 A flask is filled with 13 g of an ideal gas at 27°C and its temperature is raised to 52°C. Determine the mass of the gas that has to be released to maintain the temperature of the gas in the flask at 52°C and the pressure remaining same.

1	1 g
2	1.5 g
3	2 g

4	2.5 g

35

A particle is constrained to move on a straight line path. It returns to the starting point after 10 seconds. The total distance covered by the particle during this time is 30 m. Then determine the false statement about the motion of the particle.

1	Displacement of the particle is 30 m
2	Average speed of the particle is 3 m/s
3	Displacement of the particle is zero
4	Both (2) and (3)

36

Let two spheres of mass m and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 3. Then find the gravitational force.

1	$\dfrac{F}{9}$
2	$\dfrac{F}{3}$
3	F
4	3F

37

The frequency of a sound wave is 'n' and its velocity is 'v'. When the frequency is increased to $4n$, then determine the velocity of the wave.

1	$v/4$
2	$4v$
3	$2v$
4	v

38

If 'P' represents radiation pressure, 'c' represents speed of light and 'Q' represents radiation energy striking a unit area per second, such that $P^x Q^y c^z$ is dimensionless. Then find the values of non-zero integers x, y and z.

1	$x = 1, y = 1, z = 1$
2	$x = -1, y = 1, z = 1$
3	$x = 1, y = 1, z = -1$
4	$x = 1, y = -1, z = 1$

39

Consider two cars moving in the same direction with the same speed of 30 km/hr. They are separated by a distance of 5 km. What will be the speed of a car that is moving in the opposite direction, if it meets these two cars at an interval of 4 minutes?

1	15 km/hr

2	30 km/hr
3	40 km/hr
4	45 km/hr

40 When pressure at half the depth of a lake is equal to 2/3 pressure at the bottom of the lake, then calculate the depth of the lake.

1	60 m
2	30 m
3	20 m
4	10 m

41 It takes 2 seconds for a sound wave to travel between 2 fixed points when the day temperature is $10°$ C. When the temperature rise to $30°$ C, then determine the time in which the sound wave travels between the same fixed parts.

1	2.2 s
2	2.1 s

3	2 s
4	1.9 s

42

For silver, Young's modulus is 7.25 x 10^{10} N/m^2 and Bulk modulus is 11 x 10^{10} N/m^2. What will be its Poisson's ratio?

1	0.25
2	0.39
3	0.5
4	- 1

43

A system is given 300 calories of heat and it does 600 joules of work. Find the internal energy of the system change in this process. (J = 4.18 joules/cal)

1	- 528.2 Joule
2	- 300 Joule
3	156.5 Joule
4	654 Joule

44 Coefficient of thermal conductivity depends upon which factor?

1	Material of the plate
2	Thickness of the plate
3	Area of the plate
4	Temperature difference of two surfaces

45 Which of the following is a suitable method to decrease friction?

1	Lubrication
2	Ball and bearings
3	Polishing
4	All the above

46 Determine the necessary force to pull a circular plate of 5 cm radius from water surface for which surface tension is 75 dynes/cm.

1	750π dynes

2	750 dynes
3	60 dynes
4	30 dynes

---

47 The coefficient of friction between the tyres and the road is 0.25. Find the maximum speed with which a car can be driven round a curve of radius 40 m without skidding. (Assume g=10 ms^{-2})

1	10 ms^{-1}
2	15 ms^{-1}
3	20 ms^{-1}
4	40 ms^{-1}

---

48 A body executing simple harmonic motion has a maximum acceleration equal to 24 m/s^2 and maximum velocity equal to 16 m/s^2. Then find the amplitude of the simple harmonic motion.

1	$\dfrac{1024}{9}$ m
2	$\dfrac{64}{9}$ m

3	$\dfrac{32}{3}\,m$
4	$\dfrac{3}{32}\,m$

49

A system is taken from a given initial state to a given final state along various paths represented on a P-V diagram. Which quantity that is independent of the path?

1	Amount of work done W
2	Amount of heat transferred Q
3	Q but not W
4	(Q-W)

50

A 150 m long train is moving with a uniform velocity of 45 km/hr. How much time is taken by the train to cross a bridge of length 850 meters?

1	45 s
2	60 s
3	80 s
4	90 s

Chemistry

1

It is general principle that if the system contains less energy then system is

1	more unstable
2	unstable
3	more stable
4	less stable

2

In acid solution, given reaction $MnO_4^- \rightarrow Mn^{2+}$ involves

1	reduction by 5 electrons
2	oxidation by 5 electrons
3	reduction by 3 electrons
4	oxidation by 3 electrons

3

A number of ionic compounds e.g. $AgCl$, CaF_2, $BaSO_4$ are insoluble in water. This is due to:

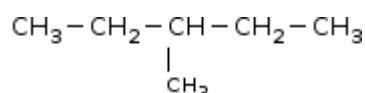| 1	Water has a high dielectric constant
2	Water is not a good ionizing solvent
3	These molecules have exceptionally high alternative forces in the lattice
4	Ionic compounds do not dissolve in water

---

4 Sample of 2, 3-dibromo-3-methylpentane is heated with zinc dust. Resulting product is isolated and heated with HI in the presence of phosphorus. Indicate which of the following structure that represent the final organic product formed in the reaction.
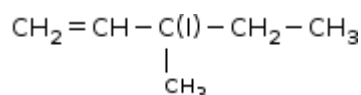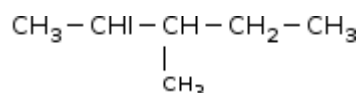
1	$CH_2=CH-\underset{\underset{CH_3}{\vert}}{CH}-CH_2-CH_3$
2	$CH_3-CH_2-\underset{\underset{CH_3}{\vert}}{CH}-CH_2-CH_3$
3	$CH_2=CH-\underset{\underset{CH_3}{\vert}}{C(I)}-CH_2-CH_3$
4	$CH_3-CHI-\underset{\underset{CH_3}{\vert}}{CH}-CH_2-CH_3$

---
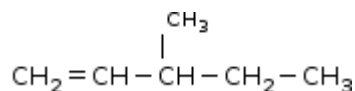
5 Find the electronic configuration of chalcogens in their outermost orbit.

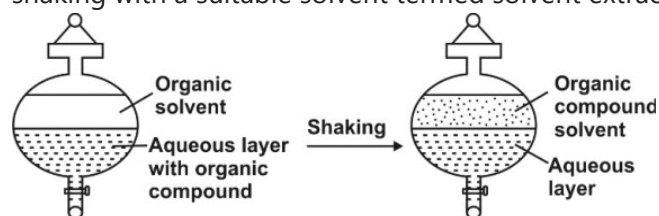| 1	s^2p^6
2	s^2p^5
3	s^2p^4
4	s^2p^3

6

The process of separation of an organic compound from its aqueous solution by shaking with a suitable solvent termed solvent extraction or differential extraction.

The organic compound present in the aqueous layer moves to the organic solvent due to

1	the organic substance is more soluble in organic solvent.
2	organic compound being lighter moves in upper layer
3	from the supersaturated aqueous solution solute starts diffusing.
4	organic solvent is insoluble in water hence organic compound moves up

---

7

The atomic weight of an element is double its atomic number. Find the element if there are four electrons in 2p orbital.

1	Ca
2	O
3	N
4	C

8 The subject matter of thermodynamic consist

1	energy transformation in a system
2	mass changes in molecular reactions
3	rates of chemical reactions
4	total energy of system

9 Among LiCl, $BeCl_2$, BCl_3 and CCl_4 the covalent bond character varies as

1	$LiCl < BeCl_2 > BCl3 > CCl_4$
2	$BCl_3 > BeCl_2 > CCl_4 > LiCl$
3	$LiCl < BeCl_2 < BCl_3 < CCl_4$

4	LiCl > BeCl$_2$ > BCl$_3$ > CCl$_4$
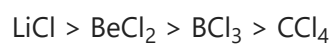
10 The molecular weight of a gas is 45. Find its density at STP in gram per litre

1	2.0
2	5.7
3	11.2
4	22.4

11 Characteristic of a reversible reaction is:

1	It can never proceed to completion
2	Number of moles of reactants and products are equal
3	It can be influenced by a catalyst
4	None of the above

12

The nucleus of an element contain 9 protons. What would be its valency?

1. 5

2. 3

3. 2

4. 1

13

In which of the following, maximum carbon-carbon bond distance is found?

1. Benzene

2. Ethane

3. Ethene

4. Ethyne

14

The charge of an electron is -1.6×10^{-19} C. What will be the value of free charge on Li^+ ion?

1. 1×10^{-19} C

2	1.6×10^{-19} C
3	2.6×10^{-19} C
4	3.6×10^{-19} C

15 The type of compounds that show high melting and boiling points are:

1	Covalent compounds
2	Electrovalent compounds
3	Coordinate compounds
4	All the three types of compounds have equal melting and boiling points

16 The pair that has both members from the same group of the periodic table is:

1	$Mg - K$
2	$Mg - Cu$
3	$Mg - Na$
4	$Mg - Ba$

17

Who proposed the theory of ionization?

1   Arrhenius

2   Faraday

3   Graham

4   Rutherford

18

For an adiabatic process

1   $\triangle U = q$

2   $\triangle U = 0$

3   $\triangle U = W$

4   $\triangle H = 0$

19

Find the number of elements in the 5th period of the periodic table.

1   32

2   18

| 3 | 10 |
| 4 | 8 |

---

20 Which of the following equation represents the Ostwald's dilution law for a weak acid HA?

1	$K_a = \dfrac{\alpha^2 c}{1 - \alpha^2}$
2	$\alpha = \dfrac{K_a c}{1 - c}$
3	$K_a = \dfrac{\alpha^2 c}{1 - \alpha}$
4	$K_a = \dfrac{\alpha c}{1 - \alpha^2}$

---

21 Which of the following chemical is added to leaded petrol to prevent the deposition of lead in the combustion chamber?

1	Ethylene dibromide
2	Iso-octane
3	Tetraethyl lead

4	Mercaptan

---

22 Why chemical property of Li and Mg is similar?

1	Because both electron affinity is same
2	Because they show diagonal relationship
3	Because both ionization potential is same
4	Because these belong to same group

---

23 Chemical equation is balanced according to the law of ____.

1	definite proportions
2	conservation of mass
3	reciprocal proportion
4	multiple proportion

---

24 The condition that represents an equilibrium is:

1	Few drops of water is present along with air in a balloon, temperature of balloon is constant
2	Freezing of ice in a open vessel, temperature of ice is constant
3	Water is boiling in an open vessel over stove, temperature of water is constant
4	All the statements (1), (2) and (3) are correct for the equilibrium

25 Equilibrium is supposed to be establish when ____ in any chemical reaction.

1	the temperature of mutual opposite reactions become equal
2	velocity of mutual reactions become equal
3	concentration of reactants and resulting products are equal
4	mutual opposite reactions undergo

26 The property of an element which is always a whole number is:

1	Atomic volume
2	Atomic number

3	Atomic weight
4	Equivalent weight

27 Which of the following statement is not correct in the reaction
$$4Fe + 3O_2 \rightarrow 4Fe^{3+} + 6O^{2-}?$$

1	Fe^{3+} is an oxidizing agent
2	Metallic iron is reduced to Fe^{3+}
3	Metallic iron is a reducing agent
4	A redox reaction

28 Electrolytes dissociate into their constituent ions when dissolved in water. Degree of dissociation of an electrolyte increases with

1	decreasing concentration of the electrolyte
2	increasing concentration of the electrolyte
3	decreasing temperature
4	presence of a substance yielding a common ion

29

What is degree of dissociation of 0.1 N CH_3COOH (Dissociation constant $= 1 \times 10^{-5}$)?

1   10^{-2}

2   10^{-3}

3   10^{-4}

4   10^{-5}

30

Why the chemistry of lithium is very similar to magnesium even though they are placed in different groups?

1   Because both have similar electronic configuration

2   Because both are found together in nature

3   Because both have nearly the same size

4   Because the ratio of their charge to size is nearly the same

31

The process of conversion of sugar $C_{12}H_{22}O_{11} \rightarrow CO_2$ is

1   reduction

2	oxidation
3	neither oxidation nor reduction
4	both oxidation and reduction

---

32 Find the type of bond formed in crystal by anion and cation.

1	Dipole
2	Covalent
3	Metallic
4	Ionic

---

33 A compound has 50% carbon, 50% oxygen and approximate molecular weight is 290. What is its molecular formula?

1	C_4O_3
2	CO
3	C_3O_3
4	$C_{12}O_9$

34

In the chemical reaction given below,

$N_2 + 3H_2 \rightarrow 2NH_3$ at equilibrium point, state whether

1	equal masses of N_2 and H_2 are reacting
2	equal volumes of N_2 and H_2 are reacting
3	the reaction has stopped
4	the same amount of ammonia is formed as is decomposed into N_2 and H_2

35

Which of the following is an electrovalent linkage?

1	BF_3
2	$SiCl_4$
3	$MgCl_2$
4	CH_4

36

In Carius method 0.099 g organic compound gave 0.287 g AgCl. What will be the percentage of chlorine in the compound?

1	28.6
2	35.4
3	64.2
4	71.7

---

37 What is paraffin wax?

1	Saturated hydrocarbon
2	Unsaturated hydrocarbon
3	Alcohol
4	Ester

---

38 Long form of periodic table possess

1	seven horizontal rows and eighteen vertical columns
2	eight horizontal rows and seven vertical columns
3	seven horizontal rows and seven vertical columns

4	eight horizontal rows and eight vertical columns

39 Chlorine atom differs from chloride ion in the no. of____.

1	electrons
2	proton
3	neutron
4	protons and electrons

40 Any series of operations so carried out that at the end, the system is back to its initial state is known as

1	cyclic process
2	adiabatic process
3	Boyle's cycle
4	reversible process

41

Following reaction describes the rusting of iron $4Fe + 3O_2 \rightarrow 4Fe^{3+} + 6O^{2-}$. Identify the incorrect statement.

1	Metallic iron is reduced to Fe^{3+}
2	This is an example of a redox reaction
3	Fe^{3+} is an oxidizing agent
4	Metallic iron is a reducing agent

42

A sample of calcium carbonate ($CaCO_3$) has the following percentage composition: Ca = 40%; C = 12%; O = 48%. If the law of constant proportions is true, then what will be the weight of calcium in 4 g of a sample of calcium carbonate obtained from another source?

1	16 g
2	1.6 g
3	0.16 g
4	0.016 g

43

0.2 molar solution of formic acid is ionized 3.2%. What is its ionization constant?

1	1.25×10^{-6}
2	4.8×10^{-5}
3	2.1×10^{-4}
4	9.6×10^{-3}

---

44 Internal energy is an example of which of the following?

1	State function
2	Path function
3	Both (1) and (2)
4	None of these

---

45 The law of multiple proportions is provided by the formation of ____ and ____

1	sulphur dioxide, sulphur trioxide
2	caustic soda, caustic potash
3	ordinary water, heavy water

4

sodium chloride, sodium bromide

46

If we want to study relative arrangement of atoms in a molecule, what should we study?

1

Molecular formula

2

Empirical formula

3

structural formula

4

none of these

47

The percentage of copper and oxygen in samples of CuO obtained by different methods were found to be the same. This illustrates the law of:

1

Conservation of mass

2

Constant proportions

3

Multiple proportions

4

Reciprocal proportions

48

Reversible reaction is one that

1. proceeds spontaneously

2. proceeds in one direction

3. proceeds in both directions

4. all the statements are wrong

49

In the nucleus of _____ , six protons are found.

1. helium

2. carbon

3. lithium

4. boron

50

A sample of pure carbon dioxide, irrespective of its source contains 72.73% oxygen and 27.27% carbon. The data supports _____.

1. law of reciprocal proportions

2	law of constant composition
3	law of conservation of mass
4	law of multiple proportions

Botany

1 _____pigments of the plant takes part in light reaction of photosynthesis.

1	Xanthophyll
2	Chl a
3	Phycoxanthin
4	Carotene

2 Recombination of genes takes place at

1	Prophase I in meiosis
2	Prophase in mitosis
3	Prophase II in meiosis

4	Metaphase II in meiosis

3 Match the following and choose the correct combination from the options given

	Column I		Column II
A	Robert Hooke	1	Mutation Theory
B	Charles Darwin	2	Swan-naked flask experiment
C	Hugo de Vries	3	Origin of Species
D	Louis Pasteur	4	Micrographia

1 A−3, B−4, C−1, D−2

2 A−2, B−1, C−3, D−4

3 A−1, B−2, C−3, D−4

4 A−4, B−3, C−1, D−2

4 To which of the following, pyrenoids in green algal cells are related?

1 Protein storage

2 Starch formation

3 General metabolism

4 Enzyme secretion

5 Which one of the following forms the spindle apparatus during cell division

1 Centrosome

2 Chromosome

3 Ribosome

4 Chondriosome

6 Where does the root hairs are found?

1 In the zone of maturation

2 Apical meristem

3 On the root cap

4 Adventitious roots

7 Under special conditions, the Parenchymatous cells of a plant tissue are totipotent which is an expression of _____ phenomena.

1	Differentiation
2	Death
3	Dedifferentiation
4	Growth

8 Xanthomonas is related to _____.

1	causing Citrus canker disease
2	a kind of Virus
3	causing disease in Xanthium
4	xanthophyceae

9 Which one of the following cell organelle is considered to be rich in catabolic enzymes?

1	Lysosome
2	Golgi body

3	Mitochondria
4	Endoplasmic reticulum

10 _____ is not a accessory pigment.

1	Chlorophyll 'e'
2	Chlorophyll 'a'
3	Phycocyanin
4	Xanthophyll

11 _____ is present in vascular bundles of gymnosperms.

1	Tracheids
2	Companion cells
3	Vessels
4	All of these

12 Who originate the theory that "cells arise only from the pre-existing cells"?

1	Virchow
2	Mohl
3	Haeckel
4	Brown

13 Which of the following gas is absorbed during photosynthesis?

1	Nitrogen
2	Oxygen
3	Ammonia
4	Carbon dioxide

14 How are the nucleic acids in chromosomes in bacteria?

1	Linear RNA

2	Circular DNA
3	Linear DNA
4	Two types of DNA and RNA

---

15   Aerobic atmosphere is maintained by _____.

1	protists
2	prokaryotes
3	plants
4	fungi

---

16   Choose the true statement for Mycoplasma.

1	Definite shape
2	Absence of cell wall
3	Presence of nucleus
4	Presence of cell wall

17 Zygospore is _____.

1 diploid

2 haploid

3 polyploid

4 none of these

18 Intercalary meristem results in _____.

1 periderm formation

2 primary growth

3 apical growth

4 secondary growth

19 Sieve tubes are suitable for translocation, because

1	Possess broader lumen and perforated cross walls
2	Possess bordered pits
3	Are broader than long
4	Possess no end walls

20   Which is the necessary pigment for photosynthesis?

1	Chlorophyll b
2	Xanthophyll
3	Chlorophyll a
4	All of the above

21   Where is "Traumatin" present?

1	In cork
2	In old leaves
3	In wood

4	In injured portion

22 ____ is symbiotic and nitrogen fixing.

1	Oedogonium
2	Anabaena
3	Cladophora
4	Spirogyra

23 Photosynthetic roots are recorded from _____.

1	rhizophora
2	jussiaea
3	bryophyllum
4	tinospora

24

Which of the following organism carry the atmospheric nitrogen-fixation?

1
Anabaena

2
Funaria

3
Chlamydomonas

4
Fern gametophyte

25

In biotechnological studies _____ alga is exploited as a rich source of protein.

1
spirulina

2
spirogyra

3
chlamydomonas

4
scytonema

26

During _____ phase(s) of cell cycle, amount of DNA in a cell remains at 4C level if the initial amount is denoted as 2C.

1
G_2 and M

2	G_0 and G_1
3	Only G_2
4	G_1 and S

27

The given figure is the representation of a certain event at a particular stage of a type of cell division.
Identify this stage.
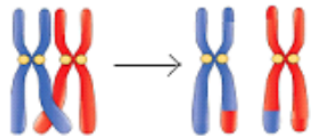
1	Prophase -I during meiosis
2	Prophase of mitosis
3	Prophase -II during meiosis
4	Both prophase and metaphase of mitosis

28

A non-membrane bound organelle found exclusively in an animal cell is:

1	Sphaerosome
2	Glyoxysome

3	Centriole
4	Peroxisome

---

29 Algae which form motile colony is:

1	Nostoc
2	Volvox
3	Spirogyra
4	Chlamydomonas

---

30 A bifacial organ bends towards, where _____.

1	darkness is there
2	growth is slow
3	growth is more
4	none of the above

31

During meiosis I, the bivalent chromosomes clearly appear as tetrads during which state?

1	Diplotene

2	Diakinesis

3	Leptotene

4	Pachytene

32

Stilt roots are found in _____ plant.

1	banyan

2	screw pine

3	spinach

4	mango

33

Membrane bound cell organelles are present in

1	In eukaryotic cells
2	In prokaryotic cells
3	In cyanobacterial cells
4	In bacterial cells

34 Axillary bud and terminal bud are produced from the activity of

1	Parenchyma
2	Intercalary meristem
3	Apical meristem
4	Lateral meristem

35 _____ mechanical tissue consisting of living cells.

1	Sclerenchyma
2	Collenchyma
3	Parenchyma

4	Chlorenchyma

36

Which one of the following pairs are correctly matched?
(1) Assimilatory roots - Photosynthesis
(2) Fasciculated roots - Food storage
(3) Stilt root - Mechanical support
(4) Sucking root - Absorption of moisture from the air
Select the correct answer -

1	1, 2 and 3
2	1, 2 and 4
3	1, 3 and 4
4	2, 3 and 4

37

When a molecule of pyruvic acid is subjected to anaerobic oxidation and produce lactic acid, there is

1	Loss of 3 ATP molecules
2	Loss of 6 ATP molecules
3	Gain of 4 ATP molecules
4	Gain of 2 ATP molecules

38 Growth of plant is differ from the growth of animals in

1. Having an indefinite span

2. Being localised

3. Having a definite life span

4. Being indefinite

39 Moll's experiment explain

1. Relation between transpiration and absorption

2. Unequal transpiration from two surfaces of leaf

3. CO_2 is required for photosynthesis

4. Chlorophyll is essential for photosynthesis

40 The study of phototropic response lead to the discovery of which of the plant hormone?

1	Cytokinin
2	Gibberellin
3	Auxin
4	Ethylene

41 Root pocket present in _____.

1	pandanus
2	maize
3	banyan
4	water hyacinth

42 _____ are the simplest green plants.

1	Algae
2	Lactobacillus
3	Bacteria

4	Yeast

43

What are the crucial events in aerobic respiration?

1	The passing on of the electrons removed as part of the hydrogen atoms to molecular O_2 with simultaneous synthesis of ATP
2	The complete oxidation of pyruvate by the stepwise removal of all the hydrogen atoms leaving three molecules of CO_2
3	Both (a) and (b)
4	None of these

44

Which of the following pairs is not correctly matched?

1	Cristae - The "Shelves'' formed by the folding of the inner membrane of the mitochondrion
2	Plasmodesmata - The membrane surrounding the vacuole in plants
3	Grana - Membrane bound discs in chloroplasts that contain chlorophylls and carotenoids
4	

Middle lamella - Layer between adjacent cell walls in plants derived from cell plate

---

45 Root is differentiated from stem in:

1	Having root hairs
2	Having a root cap
3	Absence of nodes and internodes
4	All of these

---

46 ____ used the word "chromosome''.

1	Kollikar 1888
2	Waldeyer 1888
3	Flemming 1888
4	Huxley

---

47 What is the main difference between chlorophyll 'a' and 'b' ?

1	In chlorophyll 'a' there is CH_3 group whereas in 'b' it is -CHO group
2	Chlorophyll 'a' is linear chain compound and 'b' is branched chain
3	Chlrophyll 'a' has no Mg^+ ion in centre of molecule
4	All of the above

48 How much free energy is liberated in ΔG(cal/mole) during oxidation per mole of palmitic acid?

1	- 23,38,000
2	- 6,86,000
3	- 3,26,000
4	- 4600

49 _____ phytohormones promotes male flowering and parthenocarpy.

1	Auxin
2	Gibberellin

3	Abscisic acid
4	Cytokinin

50

Where are the heterocysts found?

1	in mycoplasmas
2	in cyanobacteria
3	in bacteria
4	in viruses

Zoology

1

Nissl's granules are not present in

1	Axon
2	Dendron
3	Cyton
4	Both (1) and (2)

2 Which of the following is the chemical formula of starch?
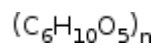
1	CH_3COOH
2	$C_{12}H_{22}O_{11}$
3	$(C_6H_{12}O_6)_n$
4	$(C_6H_{10}O_5)_n$
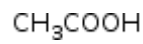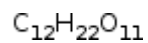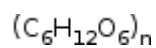
3 _____ is not an unsaturated fatty acid.

1	Oleic acid
2	Linoleic acid
3	Linolenic acid
4	Stearic acid

4 In which animals an uricotelic mode of excreting nitrogenous wastes is found?

1	Reptiles and birds

2	Birds and annelids
3	Insects and amphibians
4	Amphibians and reptiles

5 _____ is not a sensory structures in cockroach.

1	Eyes
2	Antennae
3	Anal cerci
4	Proventriculus

6 The blood cells can engulf bacteria by phagocytosis are

1	neutrophils and Lymphocytes
2	basophils and Lymphocytes
3	neutrophils and Monocytes

4	eosinophils and Basophils

---

7 A person with antigens A and B and no antibodies belongs to which blood group?

1	AB
2	A
3	B
4	O

---

8 Which of the following is a member of phylum porifera?

1	Euspongia
2	Sycon
3	Spongilla
4	All of them

---

9 The rise of blood sugar above the normal level is called as

1	Glycolysis
2	Glucosuria
3	Hyperglycemia
4	Hypoglycemia

---

10 Ball and socket joints can be seen in ____.

1	fingers
2	shoulders
3	neck
4	wrist

---

11 Pelvic girdle of man contains ____.

1	Coracoid, scapula and clavicle
2	Ilium, ischium and pubis

3	Ilium, ishcium and coracoid
4	Ilium, coracoid and scapula

12 Lipids are insoluble in water, because of lipids molecules are

1	Hydrophilic
2	Hydrophobic
3	Zwitter ions
4	Neutral

13 The blood leaving the kidney is significantly lower in _____.

1	CO_2
2	O_2
3	urea
4	glucose

14 Mark the correct statement.

1 The RBCs transports oxygen only.

2 The contraction of internal intercostal muscles lifts up the ribs and sternum.

3 The thoracic cavity is anatomically an air tight chamber.

4 Healthy man can inspire approximately 500 mL of air per minute.

15 Where are the spermathecal pores of Pheretima present?

1 In 6/7, 7/8. 8/9 and 9/10

2 In 5/6, 6/7 7/8 and 8/9

3 In 1/2, 2/3, 3/4 and 4/5

4 In 14/15, 15/16, 16/17 and 17/18

16 Choose groups of structures/organs which have similar function.

1 Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubles is rat

2	Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in Amoeba
3	Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish
4	Antennae of cockroach, tympanum of frog and clitellum of earthworm

---

17 On which basis the nomenclature of enzymes is done?

1	The type of reactions they catalyse
2	The substrate on which they act
3	The end products formed
4	Both (a) and (b)

---

18 Choose from the following which is not necessarily property of all hormones.

1	Short half-life
2	Protein in nature
3	Information carrying

4	Secreted in low amounts

---

19 Hepatic caeca in cockroach are found in between ____.

1	mesenteron and intestine
2	oesophagus and gizzard
3	gizzard and intestine
4	proventriculus and mesenteron

---

20 Choose the correct option: Bulk of carbon dioxide (CO_2) released from body tissues into the blood is present as

1	bicarbonate in blood plasma and RBCs
2	free CO_2 in blood plasma
3	carbamino -haemoglobin in RBCs.
4	70% carbamino -haemoglobin and 30% as bicarbonate

21

The amount of O_2 transported in a dissolved state through plasma is ___%.

1	20-25
2	97
3	7
4	3

22

The plant cell wall is consist of cellulose. This is believed to be

1	A polysaccharide
2	An amino acid
3	A protein
4	A liquid

23

Which of the following produces ecdysone?

1	Corpora allata
2	Prothoracic gland

3	Corpora cardiaca
4	Abdominal gland

---

24 The part of the brain directly concerned with the control of heart is

1	Cerebrum
2	Pons verolii
3	Diencephalon
4	Medulla oblongata

---

25 A natural polymer found in both insects and fungi is:

1	Pectin
2	Chitin
3	Suberin
4	Cellulose

26

In humans, ____ is not a step in respiration.

1. transport of gases by blood

2. alveolar diffusion of O_2 and CO_2

3. pulmonary ventilation

4. utilisation of CO_2 by cells for catabolic reactions

27

_____ are not ureotelic.

1. Terrestrial amphibians

2. Mammals

3. Aquatic insects

4. None of above

28

_____ is hexose sugar.

1. Galactose

2	Mannose
3	Cellulose
4	Both (1) and (2)

29 _____ amino acids play important role in ornithine cycle.

1	Arginine, methionine
2	Glycine, methionine
3	Ornithine, citrulline
4	Citrulline, glycine

30 Loss of _____ is resulted by the destruction of the anterior horn cells of the spinal cord.

1	integrating impulses
2	commissural impulses
3	sensory impulses

4	voluntary motor impulses

---

31 A certain road accident patient with unknown blood group needs immediate blood transfusion. His one doctor friend at once offers his blood. The blood group of the donor is

1	blood group AB
2	blood group B
3	blood group O
4	blood group A

---

32 Narrowest and most numerous tubes of lungs are called as ____.

1	hilum
2	bronchioles
3	alveoli
4	bronchus

33 Persons of blood group A consists of _____.

1. antigen A and antibodies a

2. antigen A and antibodies b

3. antigen A and B and no antibodies

4. no antigens and both a and b antibodies

34 _____ would allow no movements.

1. Cartilaginous joint

2. Ball and Socket joint

3. Fibrous joint

4. Synovial joint

35 Joint between the metacarpal and first phalange of the thumb is

1. hinge

2	saddle joint
3	gliding
4	perfect joint

36 The vitamin helps in blood coagulation is

1	vitamin K
2	vitamin C
3	vitamin D
4	vitamin A

37 In cockroach, where are eight blind hepatic caeca found?

1	With crop
2	At the foregut
3	At the midgut
4	At the juction of midgut and hindgut

38 The lumbar region of the vertebral column in man is made up of _____vertebrae.

1   7 vertebrae

2   1 fused vertebra

3   12 vertebrae

4   5 vertebrae

39 Which animal that passes water current through its body for food?

1   Sponge

2   Star fish

3   Hydra

4   Earthworm

40 According to accepted concept of hormone action, what happens if receptor molecules are removed from target organs?

1	The target organ will not respond to the hormone
2	The target organ will continue to respond to the hormone but in the opposite way
3	The target organ will continue to respond to the hormone without any difference
4	The target organ will continue to respond to the hormone but will require higher concentration

---

41 In cockroaches, digestive juice is secreted by which organ?

1	Hepatic caeca
2	Malpighian tubules
3	Crop
4	Gizzard

---

42 How the chemosensitive area of respiratory centre in medulla is affected?

1	Less by O_2 and H^+ ions.
2	Less by CO_2 and H^+ ions

3	Excess by CO_2 and H^+ ions
4	Excess by O_2 and H^+ ions.

43

Match the pair

Bone	Number
1. Skull	1) 24
2. Vertebrae	2) 60
3. Ribs	3) 22
4. Sternum	4) 1
5. Pectoral Girdles	5) 2
6. Arms	6) 4
7. Ear Ossicles	7) 6
8. Pelvic Girdles	8) 33

Correct pairing sequence is

1	3, 8, 1, 4, 2, 6, 7, 5
2	3, 8, 1, 4, 6, 2, 7, 5
3	8, 3, 1, 4, 6, 2, 5, 7
4	None of the above

44

In a normal healthy person at rest, what is the percentage of blood in pulmonary circulation?

1	7%
2	12%
3	40%
4	20%

---

45 Choose the correct option: In the retina, bipolar neurons synapse with

1	sensory cells and amacrine cells
2	ganglionic cells and amacrine cells
3	sensory cells and pigment cells
4	sensory cells and ganglionic cells

---

46 A large proportion of oxygen remains unused in the human blood even after its uptake by the body tissues. What is correct about O_2?

1	It acts as a reserve during muscular exercise
2	It raises the pCO_2 of blood to 75 mm of Hg

3	It is enough to keep oxyhaemoglobin saturation at 96%
4	It helps in releasing more O_2 to the epithelial tissues.

---

47   Uric acid is the chief nitrogenous waste in:

1	man
2	cockroach
3	frog
4	earthworm

---

48   Upon which of the following, the rate of hormone synthesis and secretion depends?

1	Degree of inhibition caused
2	Functional state of the tissue/organ
3	Amount of excitation in target tissue
4	Functional efficiency of the feedback system

49

_____ is likely to accumulate in a dangerous proportion in the blood of a person whose kidney is not working properly.

1	Sodium chloride
2	Ammonia
3	Lysine
4	Urea

50

Sponges are porifers as their bodies have ____.

1	several pores
2	spicules in skeleton
3	canal system
4	all the above

Physics - Answer keys

1	3
2	3

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

29	3
30	4
31	2
32	3
33	3
34	1
35	1
36	3
37	4
38	4
39	4
40	3
41	4
42	2
43	4
44	1
45	4
46	1
47	1
48	3
49	4
50	3

Chemistry - Answer keys

1	3
2	1
3	3

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

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

Botany - Answer keys

1	2
2	1
3	4
4	2

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

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

Zoology - Answer keys

1	1
2	4
3	4
4	1
5	4

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

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

Physics - Solutions

1

1 Electron volt

2

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

$\vec{R} = \vec{A} + \vec{B} = 4\hat{i} - 3\hat{j} + 8\hat{i} + 8\hat{j}$, $\vec{R} = 12\hat{i} + 5\hat{j}$

$\hat{R} = \dfrac{\vec{R}}{|R|} = \dfrac{12\hat{i} + 5\hat{j}}{\sqrt{(12)^2 + (5)^2}} = \dfrac{12\hat{i} + 5\hat{j}}{13}$

3

We know, $P = h\rho g$, therefore it is cleared that pressure does not depend upon the area of bottom surface.

4
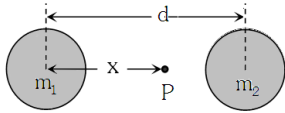
From the given data,

Force will be zero at the point of zero intensity. Therefore distance,

$$x = \frac{\sqrt{m_1}}{\sqrt{m_1} + \sqrt{m_2}} d = \frac{\sqrt{81M}}{\sqrt{81M} + \sqrt{M}} D = \frac{9}{10} D.$$

5

Let the total distance covered be 'x' in total time $(t_1 + t_2)$.

Therefore, Average speed $= \dfrac{\text{Total distance}}{\text{Total time}} = \dfrac{x}{t_1 + t_2}$

$$\Rightarrow \frac{x}{\frac{x/3}{v_1} + \frac{2x/3}{v_2}} = \frac{1}{\frac{1}{3 \times 20} + \frac{2}{3 \times 60}} = 36 \text{ km/hr}$$

6

As given in the problem, the particle is moving in circular path.
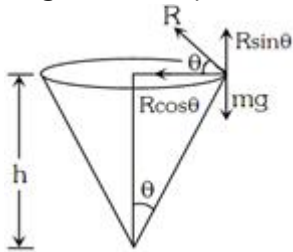
$\therefore$ From the figure, $mg = R\sin\theta$ …(i)

and $\dfrac{mv^2}{r} = R\cos\theta$ …(ii)

From equation (i) and (ii), we get

$\tan\theta = \dfrac{rg}{v^2}$ but $\tan\theta = \dfrac{r}{h}$

$\therefore h = \dfrac{v^2}{g} = \dfrac{(0.5)^2}{10} = 0.025m = 2.5 \text{ cm}$

7

Distance average speed,

$$\frac{2v_1v_2}{v_1 + v_2} = \frac{2 \times 2.5 \times 4}{2.5 + 4} = \frac{200}{65} = \frac{40}{13} \text{ km/hr}$$

8

As per given in the problem, $\dfrac{mv^2}{r} = \dfrac{k}{r^2} \Rightarrow mv^2 = \dfrac{k}{r}$

$\therefore \text{K.E.} = \dfrac{1}{2}mv^2 = \dfrac{k}{2r}$

$\therefore \text{P.E.} = \int F\,dr = \int \dfrac{k}{r^2}\,dr = -\dfrac{k}{r}$

Hence, total energy = K.E. + P.E. $= \dfrac{k}{2r} - \dfrac{k}{r} = -\dfrac{k}{2r}$

9

Suppose, $T \propto S^x r^y \rho^z$

By putting the dimension of $[T] = [T]$

$[S] = [MT^{-2}]$, $[r] = [L]$, $[\rho] = [ML^{-3}]$

And by comparing the power of both the sides, we get

$$x = -1/2,\ y = 3/2,\ z = 1/2$$

Thus, $\quad T \propto \sqrt{\rho r^3/S} \Rightarrow T = k\sqrt{\dfrac{\rho r^3}{S}}$

10

If a point have coordinate (x, y, z) then its position vector $= x\hat{i} + y\hat{j} + z\hat{k}$

11

Work done, $W = Fs = F \times \dfrac{1}{2}at^2 \left[\text{From } s = ut + \dfrac{1}{2}at^2\right]$

$\Rightarrow W = F\left[\dfrac{1}{2}\left(\dfrac{F}{m}\right)t^2\right]$

$\Rightarrow \dfrac{F^2t^2}{2m} = \dfrac{25 \times (1)^2}{2 \times 15} = \dfrac{25}{30} = \dfrac{5}{6}J$

12

Given that, Initial volume $V_1 = 47.5$ units

Final volume of $V_2 = 67$ units

and Temperature of ice cold water $T_1 = 0°C = 273$ K

By Charl's law, we have $\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$ (where temperature T_2 is the boiling point)

or $T_2 = \dfrac{V_2}{V_1} \times T_1 = \dfrac{67 \times 273}{47.5} = 385 K = 112°C$

13

Minimum force required to move the block

$= \mu_s mg = 0.5 \times 2 \times 9.8 = 9.8$ N

As the force applied is only 5 N, the block fails to move.

Hence, frictional force $=$ applied force $= 5$ N

14

We have, $PV = \mu RT$

$\Rightarrow \dfrac{P_1V_1}{P_2V_2} = \dfrac{\mu_1}{\mu_2} \Rightarrow \dfrac{50 \times 100}{100 \times V_2} = \dfrac{1}{2}$

$\Rightarrow V_2 = 100$ ml

15

As the ball rebounds with the same speed, change in it's Kinetic energy will be zero means work done by the ball on the wall is zero.

16

Displacement in first eight steps $= 5m - 3m = 2m$

Time taken for first eight steps $= 8s$

Time taken by drunkard to cover first six metres of journey $= \dfrac{8}{2} \times 6 = 24$ s

If the drunkard takes 5 steps more, he will fall into the pit so the time taken by the drunkard to cover last five steps $= 5$ s.

So, total time taken $= 24 s + 5 s = 29$ s

17

Inertia is the property of a body, which makes it unable to change by itself the state of rest and of uniform linear motion.

18

As mentioned, if the both masses are revolving about the axis yy' and tension in both the threads are equal then,

$$M\omega^2 x = m\omega^2(l-x)$$
$$\Rightarrow Mx = m(l-x) \Rightarrow x = \frac{ml}{M+m}$$
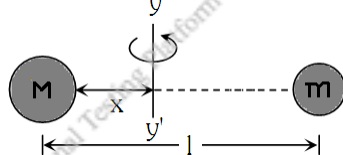
19 Here, average velocity is zero because in complete revolution, total displacement is zero.

20
$$\vec{r} = \vec{r}_2 - \vec{r}_1 = (-2\hat{i} - 2\hat{j} + 0\hat{k}) - (4\hat{i} - 4\hat{j} + 0\hat{k})$$
$$\vec{r} = -6\hat{i} + 2\hat{j} + 0\hat{k}$$
$$\therefore |\vec{r}| = \sqrt{(-6)^2 + (2)^2 + 0^2} \Rightarrow \sqrt{36+4} = \sqrt{40} = 2\sqrt{10}$$

21 Apple falls away from the hand of a person in the direction of motion of the train because horizontal velocity of apple will remain same but due to retardation of train, velocity of train and hence velocity of person w.r.t. ground decreases.

22
In SHM,
$$x = A\sin\omega t = A\sin\frac{2\pi}{T}t$$
At $t = 1\,s$, $x = \dfrac{A}{2}$ $\Rightarrow \dfrac{A}{2} = A\sin\dfrac{2\pi}{T}$ or $\dfrac{1}{2} = \sin\dfrac{2\pi}{T}$

or $\sin\dfrac{\pi}{6} = \sin\dfrac{2\pi}{T}$ or $T = 12\,s$

23
Energy $(E) = F \cdot d \Rightarrow F = \dfrac{E}{d}$, thus Erg/metre can be the unit of force.

24 The sixth coin is under the weight of four coins above it.
So, Reaction of the 6th coin on the 7th coin
= Force on the 6th coin due to 7th coin $= 4mg$

25 Here, coefficient of friction between the table and the chain is given by,
$$\mu = \frac{\text{Length of chain hanging from the table}}{\text{Length of chain lying on the table}} = \frac{l}{L-l}$$

26
Here,
$$X = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3 + m_4 x_4}{m_1 + m_2 + m_3 + m_4}$$
$$\therefore X = \frac{0 + 40 x_4}{100} \Rightarrow 3 = \frac{40 x_4}{100} \Rightarrow x_4 = \frac{300}{40} = 7.5$$
Same as the above, $y_4 = 7.5$ and $z_4 = 7.5$

27
Temperature difference, $\Delta\theta = \dfrac{Q \times l}{KAt}$
$$\Rightarrow \Delta\theta = \frac{4000 \times 0.1}{400 \times 10^{-2}} = 100°C$$

28 We know that, at critical temperature ($T_c = 370°C = 643\,K$), the surface tension of water is zero.

29

It is based on Seebeck Effect.

30

10^{-15} m

31

Here, velocity of centre of mass,

$$\vec{v}_{cm} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2} = \frac{200 \times 10\hat{i} + 500 \times (3\hat{i} + 5\hat{j})}{200 + 500}$$

$$\Rightarrow \vec{v}_{cm} = 5\hat{i} + \frac{25}{7}\hat{j}$$

32

Here, Young's modulus = $\frac{stress}{strain}$

As the length of wire get doubled, therefore strain = 1

$\therefore$ Y = strain = 20 Å— 10^8 N/m^2

33

Acceleration, displacement and electric field are vector quantities.

34

We have, $PV = mrT$. As P, V, r $\Rightarrow$ remains same

Therefore, $m \propto \frac{1}{T}$

$$\frac{m_1}{m_2} = \frac{T_2}{T_1} \Rightarrow \frac{13}{m_2} = \frac{(273 + 52)}{(273 + 27)} = \frac{325}{300}$$

$\Rightarrow m_2 = 12$ g

It means mass released = 13 g - 12 g = 1 g

35

The displacement of the particle will be zero since it comes back to its starting point.

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{30 \text{ m}}{10 \text{ sec}} = 3 \text{ m/s}$$

36

Gravitational force is independent of the medium.

37

Velocity of sound does not depend upon frequency. Hence, it is same (v) for frequency n and 4n.

38

By putting the dimension of given quantities $[ML^{-1}T^{-2}]^x[MT^{-3}]^y[LT^{-1}]^z = [MLT]^0$

By comparing the power of M, L, T in both sides

$x + y = 0$ .....(i)

$-x + z = 0$ .....(ii)

$-2x - 3y - z = 0$ ....€¦(iii)

Only values of x, y, z satisfy the equations (i), (ii) and (iii) corresponds to option (4).

39

Two cars (A and B) are moving with same velocity, the relative velocity of one car (B) with respect to the other car (A), $\vec{v}_{BA} = \vec{v}_B - \vec{v}_A = v - v = 0$ and the relative separation between them (5 km) always remains the same.

Now, if the velocity of car (C) moving in opposite direction to (A) and (B), is $\vec{v}_C$ relative to ground, then the velocity of car (C) relative to (A) and (B) will be $\vec{v}_{rel.} = \vec{v}_C - \vec{v}$. But as $\vec{v}$ is opposite to v_C.

$\therefore v_{rel} = v_c - (-30) = (v_C + 30)$ km/hr.

∴The time taken by it to cross the cars A and B,

$t = \dfrac{d}{v_{rel}} \Rightarrow \dfrac{4}{60} = \dfrac{5}{v_C + 30} \Rightarrow v_C = 45$ km/hr.

40

Here, pressure at bottom of the lake $= P_0 + h\rho g$

Pressure at half the depth of a lake $= P_0 + \dfrac{h}{2}\rho g$

∴From the given condition in the problem,

$P_0 + \dfrac{1}{2}h\rho g = \dfrac{2}{3}(P_0 + h\rho g) \Rightarrow \dfrac{1}{3}P_0 = \dfrac{1}{6}h\rho g$

$\Rightarrow h = \dfrac{2P_0}{\rho g} = \dfrac{2 \times 10^5}{10^3 \times 10} = 20$ m

41

Let the distance between two fixed points is 'd' then,

$t = \dfrac{d}{v}$. Also $v \propto \sqrt{T} \Rightarrow \dfrac{t_1}{t_2} = \dfrac{v_2}{v_1} = \sqrt{\dfrac{T_2}{T_1}}$

$\Rightarrow \dfrac{2}{t_2} = \sqrt{\dfrac{303}{283}} \Rightarrow t_2 = 1.9$ sec

42

From the given information,

$Y = 3K(1 - 2\sigma)$

$\therefore \sigma = \dfrac{3K - Y}{6K} = \dfrac{3 \times 11 \times 10^{10} - 7.25 \times 10^{10}}{6 \times 11 \times 10^{10}} = 0.39$

43

As $J\Delta Q = \Delta U + \Delta W$, $\therefore \Delta U = J\Delta Q - \Delta W$

$\Rightarrow \Delta U = 4.18 \times 300 - 600 = 654$ Joule

44

It is the property of material.

45

In the given options, ball and bearing produce rolling motion for which force of friction is low and lubrication and polishing reduce roughness of surface.

46

Here, the total length of the circular plate on which the force will act $= 2\pi R$

∴Force to pull $= 2\pi RT = 2 \times \pi \times 5 \times 75 = 750\pi$ dynes

47

The maximum speed,

$v = \sqrt{\mu rg} = \sqrt{0.25 \times 40 \times 10} = 10$ m/s

48

Given: Maximum velocity $= a\omega = 16$

and Maximum acceleration $= \omega^2 a = 24$

∴Amplitude, $a = \dfrac{(a\omega)^2}{\omega^2 a} = \dfrac{16 \times 16}{24} = \dfrac{32}{3}$ m

49

The only quantity (Q-W) which itself is the internal energy of the system is independent of the path.

50

To cross the bridge, total distance to be covered by the train;

= length of train + length of bridge

= 150 m + 850 m = 1000 m

$$\text{Time} = \frac{\text{Distance}}{\text{Velocity}} = \frac{1000}{45 \times \frac{5}{18}} = 80 \text{ s}$$

Chemistry - Solutions

1

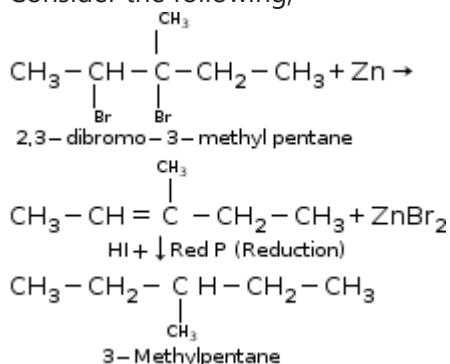The less is the energy of a system, more is its stability

2

$5e^-$ are required for the reduction of Mn^{2+} as $MnO_4^- + 5e^- \rightarrow Mn^{2+}$ in $MnO_4^- \rightarrow Mn^{2+}$.

3

These molecules have exceptionally high alternative forces in the lattice.

4

Consider the following,

$$CH_3-CH-\overset{\overset{CH_3}{|}}{C}-CH_2-CH_3 + Zn \rightarrow$$
$$\underset{Br}{|} \quad \underset{Br}{|}$$

2,3-dibromo-3-methyl pentane

$$CH_3-CH=\overset{\overset{CH_3}{|}}{C}-CH_2-CH_3 + ZnBr_2$$

$HI + \downarrow$ Red P (Reduction)

$$CH_3-CH_2-\overset{}{C}H-CH_2-CH_3$$
$$\underset{CH_3}{|}$$

3-Methylpentane

5

Electronic configuration of chalcones is s^2p^4. chalcogens are the oxygen family.

6

TThe organic compound present in the aqueous layer moves to the organic solvent due to the organic substance being more soluble in organic solvent is transferred from aqueous layer to the organic layer.
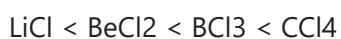
7

Here, $_8O = 1s^2 2s^2 2p^4$.

8

Energy transformation in a system

9

More the charge density of cation more is the covalent character hence ,

LiCl < BeCl2 < BCl3 < CCl4

10

Here, density of gas $= \dfrac{\text{molecular wt. of metal}}{\text{volume}}$

$= \dfrac{45}{22.4} = 2$ gm liter^{-1}

11

Some amount of the reactants remains unconverted into products in a reversible reaction.

12   As its nucleus contain 9 proton, so its atomic number is 9 and its electronic configuration is 2, 7. So it requires one more electron to complete its octet. Thus, its valency is 1.

13   In C_2H_6, $C-C$ bond length is 1.54 Å... (maximum)

14 1.6×10^{-19} C

15   Both melting point and boiling point of electrovalent compounds are high because of strong electrostatic force of attraction between the ions.

16   Both Mg-Ba belongs to II-A group.

17   The theory of ionization was proposed by Arrhenius.

18
$for\ an\ adiabatic\ process\ \triangle U = W$
$as\ \triangle U = W + q$
$and\ q = 0$

19   18

20   This is the mathematical form of Ostwald's dilution law.

21   Ethylene dibromide

22   Because they show diagonal relationship.

23   Conservation of mass

24   Equilibrium can be achieved in closed vessel only.

25   Equilibrium is supposed to be established, when rate of forward reaction is equal to the rate of backward reaction.

26   Atomic number

27   In the reaction $4\overset{0}{Fe} + 3O_2 \rightarrow 4\overset{3+}{Fe} + 6O^{2-}$, metallic iron is oxidized to Fe^{3+}.

28   Since the degree of dissociation is inversely proportional to the concentration of the electrolyte.

29

Given, Normality of solution = 0.1 N $= \frac{1}{10} N$

Volume = 10 litre

Dissociation constant $K = 1 \times 10^{-5}$

$\therefore K = \frac{\alpha^2}{V} \Rightarrow \alpha = \sqrt{KV} = \sqrt{1 \times 10^{-5} \times 10}$

Degree of dissociation $\Rightarrow \alpha = 1 \times 10^{-2}$

30

Because the ratio of their charge to size is nearly.

31

In the conversion of sugar $C_{12}H_{22}O_{11} \rightarrow CO_2$ process, oxidation occurs.

32

In general, cation and anion form ionic bond.

33

Elements	Simple ratio
C = 50	50/12 = 4
O = 50	50/16 = 3

Now, Empirical formula = C_4O_3

Empirical formula mass = 96

$n = \frac{290}{96} = 3$

$\therefore$ Molecular formula = $(C_4O_3)_3 = C_{12}O_9$

34

Rate of forward reaction is same as the rate of backward reaction at equilibrium.

35

$MgCl_2$ has electrovalent linkage as magnesium is electropositive metal whereas chlorine is electronegative.

36

Percentage of chlorine = $\frac{35.5}{143.5} \times \frac{\text{Mass of AgCl}}{\text{Mass of substance}} \times 100$

$= \frac{35.5}{143.5} \times \frac{0.287}{0.099} \times 100 = 71.71\%$

37

Saturated hydrocarbon

38

Seven horizontal rows and eighteen vertical columns.

39

Cl and Cl^- differs in number of electrons. Cl has $17e^-$ whereas Cl^- has $18e^-$.

40

In case of cyclic process, a system in a given state goes through a series of different processes, but in the end returns to the initial state.

41

As the metallic iron is oxidized to Fe^{3+}

42

1.6 g

43

Ionization constant is:

$$K_a = C\alpha^2 = 0.2 \times \left(\frac{32}{100}\right)^2$$
$$\Rightarrow K_a = 2.048 \times 10^{-4}$$

44

Functions whose value depends only on the state of a system are called as the state functions.

45

Sulphur dioxide and Sulphur trioxide

46

Structural formula.

47

Constant proportions

48

Reversible reaction always attains equilibrium that proceeds both sides, also never goes for the completion.

49

Atomic no. of C = 6, therefore the number of protons in the nucleus = 6.

50

Law of constant composition

Botany - Solutions

1

Chl a

2

The crossing over of homologous chromosome takes place in Pachytene of prophase first of meiosis. It is termed as recombination.

3

A$-$4, B$-$3, C$-$1, D$-$2

4

Starch formation

5

Centrosome

6

In the zone of maturation

7

Under certain condition, parenchymatous cells of a plant tissue which is a permanent tissue undergoes dedifferentiation and start dividing and form undifferentiated mass of cell called callus.
Dedifferentiation process involves activation of certain genes which not only reverse differentiation but also stimulates cell division. Cork cambium, and interfascicular vascular cambium are always produced through dedifferentiation.

8

Causing Citrus canker disease

9

Mitochondria is responsible for the process of respiration which is either destructive or catabolic process.

10

Chlorophyll 'a' is a necessary pigment, not accessory.

11

Trachieds are mainly found in gymnosperms whereas vessels are found in angiosperms.

12

Virchow gave 'Omnis cellula a cellula' theory.

13

Carbon dioxide

14

Circular DNA

15

As O_2 is released during photosynthesis.

16

Absence of cell wall

17

Zygospores are product of sexual reproduction which are diploid.

18

Primary growth

19

Possess broader lumen and perforated cross walls

20

Chlorophylls are the green pigments for the process of photosynthetic. Five types of chlorophylls occur in plants a, b, c, d and e respectivelly. Out of these only two chlorophylls occur in the chloroplasts of higher plants, a and b. The amount of chlorophyll b is roughly one fourth of total chlorophyll content. Chlorophyll a is found in all photosynthetic plants except bacteria. So, it is termed as universal photosynthetic pigment. It is also called primary photosynthetic pigment because it performs primary reaction of photosynthesis which involves conversion of light into chemical or electrical energy. Other photosynthetic pigments are called accessary pigments.

21

Injured portion

22

Anabaena is found symbiotically in Azolla and help in N_2 fixation.

23

Tinospora

24

Anabaena

25 Spirulina viridisma: It is a convoluted cyanophycian alga, which has 60% protein contents.

26 A cell cycle is divided into four phases i.e. G_1, S, G_2 and M phases. G_1 or first growth phase is followed by S phase in which DNA replication occurs and DNA amount doubles up i.e., a cell with 2C DNA in G_1 phase will now have 4C DNA. G_2 phase is second growth phase where DNA content remains 4C and M phase is the phase of division where DNA content either regains 2C level (mitosis) or becomes halved ie. 1C (in meiosis). G_0 phase is the phase of differentiation where cell contains DNA as in the same amount as its parent cell and does not divide further.

27 The figure shows crossing over i.e., exchange of segments between two homologous chromosomes and crossing overs is characteristics of meiosis and occurs during pachytene stage of prophase -I.

28 Centriole

29 Volvox

30 Growth is slow

31 In pachytene the chromatids of each synapsed chromosomes slightly separate and become visible. The two visible chromatids of a chromosome are known as a dyad. A group of four homologous chromatids (two dyads) is termed as tetrad. The two chromatids of the same chromosome are called sister chromatids and those of two homologous chromosomes (bivalent) are termed non- sister chromatids.

32 screw pine

33 Cell organelles like mitochondria, golgi complex, E.R. and lysosomes are present only in eukaryotes

34 Apical meristem

35 Collenchyma cells are mechanical tissue, they possess thickening of corners of cells.

36 Sucking roots penetrates the host as well as withdraw water, nourishment or both e.g. Cuscuta.

37 Loss of 3 ATP molecules

38

In plants, growth occurs in localized area i.e. apical, lateral and intercalary region whereas in animals growth takes place in whole body.

39

CO_2 is required for photosynthesis

40

Charles Darwin and his son Francis Darwin observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards the light source (phototropism) and after a series of experiments, it was concluded that the tip of coleoptiles contain auxin that caused the bending of the entire coleoptile in relation to the direction of light.

41

Many aquatic plants have elongated loose cap like covering over their tips which are called root pockets, e.g. Water Hyacinth (Eichhornia).

42

Chloroplast are not found in yeast, bacteria and Lactobacillus.

43

both (a) and (b)

44

As the membrane which surrounds the vacuole is called as tonoplast.

45

All of these

46

Waldeyer 1888

47

In chlorophyll 'a' there is CH_3 group whereas in 'b' it is -CHO group

48

- 3,26,000

49

Gibberellin phytohormones promotes male flowering and parthenocarpy. It has masculating effect in some plants e.g., it promotes male flowering in genetically female flowers of Cannabis and seedless pomaceous fruits can be produced by application of gibberellins to unpollinated flowers (parthenocarpy).

50

Some cyanobacteria possess heterocyst such as Nostoc, Scytonema etc.

Zoology - Solutions

1

Axon is a single long process of uniform thickness which contain neurofibrils and neurotubules but lack nissle's granules, golgi complex ribosomes etc.

2

$(C_6H_{10}O_5)_n$

3

Stearic acid

4   The event of excretion of uric acid is known as uricotelism and animals which excrete their nitrogenous wastes mainly in the form of uric acid are called as uricotelic animals. Uricotelic animals include most insects (e.g., cockroach), some land crustaceans (e.g.,Oniscus commonly known as "wood louse"), land snails, land reptiles (e.g., lizards and snakes) and birds.

5   Proventriculus is not a sensory structures in cockroach. Antennae perceive touch as they have tectile sensillae and smell as they have olfactory sensillae. Eyes are organs of sight. Anal cerci bear auditory sensillae or the sensillae for hearing. Maxillary palps have gustatory (taste receipting) and olfactory (smell receipting) sensillae. So all of these are sense organs. Proventriculus is gizzard. It is thick walled and has six teeth which are used for grinding of food.

6   Neutrophils are large with many lobed nucleus and abundant granules. Neutrophils are phagocytic in nature and are the present in large amount. Monocytes are the largest of all types of leucocytes and somewhat amoeboid in shape. They have clear cytoplasm without cytoplasmic granules) and the nucleus is bean-shaped and they are motile and phagocytic in nature and engulf bacteria and cellular debris.

7   A person having blood group AB possess both the antigen A and B but their blood plasma does not possess any of the antibodies.

8   All of them

9   Hyperglycemia

10   Shoulder and hip joints represents the examples of ball and socket joints.

11   Pelvic girdle has the usual three bones ilium, ischium and pubis which are fused together into a single innominate or hip bone.

12   Hydrophobic

13   Blood leaving the kidney is lower in urea, O_2 and glucose, but higher in CO_2. In other organs urea contents of blood would increase whereas in kidney urea will be filtered from blood.

14   The thoracic cavity is the space within the thorax which in vertebrates contains the heart, lungs and rib cage.

15   Four pairs of spermatheca are present in earthworm that are situated a pairs in the each 6th, 7th, 8th and 9th segments. They opens outside on inter segmental grove 5/6, 6/7, 7/8, 8/9.

16   Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubles is rat

17

In modern system of nomenclature, enzyme names are given after (a) substrate on wich enzymes act , e.g., sucrase (after sucrose), lipase, proteinase, nuclease, peptidase, maltase etc. (b) chemical reaction which they catalyzed, e.g., dehydrogenase, oxidase, carboxylase, decarboxylase, etc. The second category of names are group names. They are often qualified by the addition of the name of substrate, e.g., succinic dehydrogenase, Isocitric dehydrogenase, glutamate- pyruvate transaminase, DNA polymerase, etc.

18

Hormones do not belong to a single chemical group and they are varied in their composition is polypeptide, proteins, amines or steroid.

19

Proventriculus is also called as Gizzard

20

At the tissue site where partial pressure of CO_2 is high because of catabolism, CO_2 diffuses into blood (RBCs and plasma) and forms HCO_2^- and H^+. At the alveolar site where pCO_2 is low, the reaction proceeds in the opposite direction leading to the formation of CO_2 and H_2O.

Therefore, CO_2 trapped as bicarbonate at the tissue level and transported to the alveoli is released out as CO_2.

21

The amount of O_2 transported in a dissolved state through plasma is 3%. Oxygen is transported through blood either as dissolved gas or as oxyhaemoglobin. About 3 percent of oxygen in the blood is dissolved in the plasma that carries oxygen to the body cells whereas about 97 percent of oxygen is carried in combination with haemoglobin of the erythrocytes.

22

A polysaccharide is consist of many units of monosaccharides

23

Moulting is controlled by a steroid hormone ecdyson which is introduced by prothoracic glands.

24

Medulla oblongata controls involuntary functions of body through a number of centres such as cardiac centres (heart beat).

25

Chitin natural polymers is found both in insects and fungi. It is present in both insects and fungi. The body of insects, such as cockroach is externally covered by hard brown chitinous plates which constitute the exoskeleton. Fungal chitin is made up of acetyl glucosamine, present in hyphae or cell wall.

26

In humans, utilisation of CO_2 by cells for catabolic reactions is not a step in respiration. Respiration is an energy releasing, enzymatically controlled catabolic process which involves sequentially oxidative breakdown of food substances inside living cells. This oxidative breakdown of food materials within the cell, release energy which is used in the synthesis of ATP.
Thus, oxygen (not carbon dioxide) is utilised by cells for these catabolic reactions.

27 Aquatic insects are not ureotelic but ammonotelic in nature. Ammonia is excreted by aquatic animals through diffusion across body surface or through gill surfaces (fish) as ammonium ions. Mammals and terrestrial amphibians mainly excrete urea and are ureotelic. Whereas birds excrete nitrogenous waste as uric acid in the form of pellet or paste with minimum loss of water and are uricotelic.

28 Both (1) and (2)

29 Ornithine, citrulline

30 Loss of voluntary motor impulses is resulted by the destruction of the anterior horn cells of the spinal cord. The anterior horns of spinal cord contains cells with fibres which form the anterior (motor) root end and are essential for the voluntary and reflex activity of muscles they innervate. If the anterior horn motor cells are destroyed, the nerves cannot regenerate and muscles are never useful again.

31 The blood group of donor was O. The person with O blood group is universal donor. It lacks both antibodies 'a' and 'b' therefore do not cause agglutination or clumping of blood cells when transfused into person with any of the four blood groups.

32 Bronchioles

33 Antigen A and antibodies b

34 Fibrous joint would allow no movements. Fibrous/ immovable joints are the joints in which no movement occurs between the bones concerned. White fibrous tissue is present between the ends of the bones. Fibrous joint occurs between the bones of the skull known as sutures and the joints between the teeth and the maxilla, and teeth and the mandible.

35 Saddle joint

36 The vitamin helps in blood coagulation is vitamin K.

37 at the midgut

38 Our vertebral column is made up of 26 serially arranged units known as vertebrae and is dorsally placed. It extends from the base of the skull and constitutes the main framework of the trunk. The vertebral column is differentiated into cervical (7), thoracic (12), lumber (5), sacral (1-fused) and coccygeal (1-fused) regions starting from the skull.

39 Sponge

40 The target organ will not respond to the hormone

41 In cockroaches, digestive juice is secreted by Hepatic caeca. It open into the anterior end of midgut and are 7 or 8 short, narrow blindly ending hollow tubes. These are internally lined by epithelium and secrete digestive enzymes.

42 Human have a significant ability to maintain and moderate the respiratory rhythm to as per the demands of the body tissues. A specialized centre present in the medulla region of the brain known as respiratory rhythm centre is primarily responsible for this regulation. A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO_2 and hydrogen.

43 3, 8, 1, 4, 6, 2, 7, 5

44 Two major parts of blood circulation are systematic and pulmonary circulation. Out of these, the systemic circulation contains about 84% of blood. From remaining 16% of blood about 7% is contained in heart and about 9% in pulmonary circulation.

45 Different neuronal cell types like rods and cones, horizontal cells, bipolar cells, amacrine cells, ganglionic cells, etc present in retina. The bipolar cells transmit signals vertically from the rods, cones and horizontal cells to the inner plexiform layer, where they synapse with ganglionic cells and amacrine cells.

46 This O_2 acts as a reserve during muscular exercise.

47 The process of excretion of uric acid is known as uricotelism and animals which excrete their nitrogenous wastes mainly in the form of uric acid are called as uricotelic animals. Uricotelic animals include most insects (e.g., cockroach), some land crustaceans (e.g.,Oniscus commonly known as "wood louse"), land snails, land reptiles (e.g., lizards and snakes) and birds.

48 Decrease or increase in the circulating amount of a hormone has a directly inverse effect on the amount and it is to be secreted by concerned gland cells this is termed as the feed back control mechanism.

49 As kidney removes urea.

50 Several pores