# Sample Paper Class 9 CBSE 2020-21

## **General Instructions**

- The question paper comprises four sections A, B, C, and D. There are 36 questions in the question paper. All questions are compulsory.
- (ii) (Section-A question no. 1 to 20 all questions and parts thereof are of one mark each. These questions contain multiple-choice questions (MCQs), very short answer questions, and assertion reason type questions. Answers to these should be given in one word or one sentence.
- (iii) Section-B question no. 21 to 26 are short answer type questions, carrying 2 marks each. Answers to these questions should be in the range of 30 to 50 words.
- (iv) Section-C question no. 27 to 33 are short answer type questions, carrying 3 marks each. Answers to these questions should be in the range of 50 to 80 words.
- (v) Section-D question no. 34 to 36 are long answer type questions carrying 5 marks each. Answers to these questions should be in the range of 80 to 120 words.
- (vi) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(vii) Wherever necessary, neat, and properly labelled diagrams should be drawn.

### Section-A

1. Seawater can be classified as homogeneous as well as a heterogeneous mixture.' Comment.

#### OR

Chadwick discovered a subatomic particle that has no charge and has a mass nearly equal to that of a proton. Name the particle and give its location in the atom.

- 2. What do you mean by one mole of a substance?
- 3. The atomic number of an element X is 13. What will be the number of electrons in its ion  $X^{3+}$ ?
  - A. 11 B. 15
  - B. 16 D. 10
- 4. Give one example of a motion where an object does not change its speed but its direction of motion changes continuously.
- 5. Explain why the motion of a body which is moving with constant speed in a circular speed in a circular path is said to be accelerated.
- 6. The mass of object A is 6 kg whereas that of another object B is 34 kg. Which of the two objects, A or B, has more inertia?

## OR

Explain why it is dangerous to jump out of a moving bus.

- 7. Which of Kepler's laws of planetary motion led Newton to establish the inverse-square rule for gravitational force between two bodies?
- 8. What is the power of a body which is doing work at the rate of one joule per second?
- 9. An electric bulb of 60 W is used for 6 h per day. Calculate the energy consumed in one day by the bulb in kWh.

## OR

An object of 10 kg moves with a uniform velocity of 2 m/s, what is the kinetic energy possessed by the object?

- 10. The two forms of oxygen found in the atmosphere are
  - a. Water and ozone
  - b. Water and oxygen
  - c. Ozone and oxygen

- d. Water and carbon dioxide
- 11. Where genes are located?
- 12. Name the cell which is attached to the lateral side of the sieve tube.
- 13. Which microorganism is considered as the borderline of living and dead? Name two diseases caused by this microbe.
- 14. DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of the reason (R).

Assertion (A): In a gaseous state, particles move randomly at high speed.

Reason (R): The particles of gases have the least forces of attraction.

- A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of the assertion
- B. Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- C. Assertion (A) is true but reason (R) is false.
- D. Assertion (A) is false but reason (R) is true.
- 15. Assertion(A): Cartilage is a type of connective tissue that can bend easily Reason(R): It has a very tightly packed matrix and cells.
  - A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of the assertion
  - B. Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
  - C. Assertion (A) is true but reason (R) is false.
  - D. Assertion (A) is false but reason (R) is true.
- 16. Assertion: Instantaneous speed is the speed of a body over a long period of time.

Reason: The graph representing non-uniform speed will be a curve with an increasing or decreasing slope.

- A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of the assertion
- B. Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- C. Assertion (A) is true but reason (R) is false.
- D. Assertion (A) is false but reason (R) is true.

17. Answer question numbers (a) to (d) based on your understanding of the following paragraph and related to studied concepts.

In some organisms like bacteria, the nuclear region of the cell may be poorly defined due to the absence of a nuclear membrane. Such an undefined nuclear region containing only nucleic acids is called a nucleoid. Such organisms, whose cells lack a nuclear membrane, are called prokaryotes (Pro = primitive or primary; karyote, karyon = nucleus). Organisms with cells having a nuclear membrane are called eukaryotes.



- (a) What is the basic difference between a eukaryotic and prokaryotic cell?
- (b) In the given figure label the nuclear region.
- (c) The prokaryotes have a nuclear region. Will they also have nucleoplasm?
- (d) Do viruses have a nucleus or nucleoid or nucleic acid?
- 18. Read the following and answer any **four** questions from (a) to (e).

The given figure depicts the atomic structure of an atom of an element  $\ensuremath{`X'}.$ 

Write the following information about the element 'X'.



- (a) Atomic number of 'X'
- (b) Atomic mass of 'X'
- (c) Valence electrons

- (d) Valency of 'X'
- (e) 'X' should be metal or non-metal.
- 19. Read the following and answer any **four** questions from (a) to (e)
  - (a) What elements do the following compounds contain?

Sugar, Common salt

- (b) What are pure substances? Give two examples of pure substances.
- (c) What are the two types of pure substances? Give one example of each type.
- (d) Which of the following are 'pure substances'?

Ice, Milk, Iron, Hydrochloric acid, Calcium oxide, Mercury, Brick, Wood, Air

- (e) What is the other name for impure substances? Give two examples of impure substances.
- 20. Read the passage answer any **four** questions among (a) to (e)

The principle of conservation of linear momentum states that if in any assigned direction the net external force on a system is zero, then the linear momentum of the system will remain constant. Thus, it can be concluded that if the momentum of a two-particle system is initially zero, then because of internal forces they will move in opposite directions to conserve momentum.

- (a) State the principle of conservation of linear momentum.
- (b) Suppose you are on a cart initially at rest on a frictionless track. If you throw a ball off the cart towards the left with a velocity v, will the cart be put into motion?
  - A. Yes, and it will move to the right with the same velocity.
  - B. Yes, and it will move to the right with the same momentum.
  - C. It may move left or right depending upon the mass of the ball.
  - D. No, it will remain in place.
- (c) Suppose the cart of the previous question is a little bit modified and it has a vertical wall type surface on it as shown in the figure. You throw a ball at this vertical surface that is firmly attached to the cart.

After the ball has bounced straight back from the surface as shown in the picture, will the cart be seen having motion?



- A. Yes, and it will move to the right.
- B. Yes, and it will move to the left.
- C. It may move left or right depending upon the mass of the ball
- D. No, it will remain in place.
- (d) The difference between the initial and final momentum of 2 bodies in a straight-line collision when no external force acts on either is
  - A. twice of initial momentum
  - B. twice of final momentum
  - C. zero
  - D. half of initial momentum
- (e) How will the momentum of a ball change if it collides with a wall while moving at constant velocity on a frictionless surface?

## Section-B

21. Why antibiotics don't work against viruses. Justify.

## OR

Draw the structure of a neuron.

- 22. Define the terms
  - a. Ecosystem
  - b. Biodiversity
- 23. Compare suspension and colloidal solution on the basis of
  - 1. type of mixture
  - 2. particle size

#### OR

Give two points of difference between an element and a compound.

- 24. State:
  - (a) Law of Conservation of mass
  - (b) Law of constant proportion

25. A particle travels along the edges of an equilateral triangle, as shown. It starts from A and then completes a round of the perimeter of the equilateral triangle and arrives at A again. It has a velocity of 6 m/s and takes 2 seconds to complete the journey. What is the displacement of the particle?



26. For a race car moving with a constant velocity of 20 m/s on a circular track with a radius of 100 m, what is the time taken for a complete one revolution?

#### Section-C

27. Differentiate between isotonic, hypotonic, and hypertonic solutions.

OR

Write a short note on AIDS

- 28 Define the following terms:
  - a. Ammonification
  - b. Nitrification
  - c. Denitrification
- 29. Differentiate between xylem and phloem tissues.
- 30. (a) State the mathematical relation of Newton's second law of motion

(b) A block of metal weighing 2 kg is resting on a frictionless plane. It is struck by a jet releasing water at the rate of 1 kg s<sup>-1</sup> and at a speed of 5 m s<sup>-1</sup>. Determine the initial acceleration of the block. (Take mass flow rate of water as = m/t, where m is the mass of water flowing in time t.

31. (a) The atomic species A and B have different numbers of protons but the same number of nucleons. On the other hand, the atomic species X and Y have the same number of protons but different numbers of nucleons. Which pair is an example of isobars? Why? (1)

(b) Composition of the nuclei of two atomic species A and B is given as under: (2)

A B Protons: 18 20 Neutrons: 22 20

Give the mass numbers of A and B. What is the relation between the two species and which element or elements they represent?

- 32. (a) Define the atomic mass unit.
  - (b) Distinguish between molecular mass and molar mass.
- 33. The radii of the two planets are respectively  $R_1$  and  $R_2$  and their densities are respectively  $\rho_1$  and  $\rho_2$ . Determine the ratio of the accelerations due to gravity at their surfaces ( $g_1$ :  $g_2$ ).

#### Section-D

- 34. (a) Explain why chlorine, whether as the element or its compounds, always has a relative atomic mass of about 35.5 u.
  - (b) An element 'A' has valency +3, while another element 'B' has valency -2. Give the formula of their compound formed when 'A' reacts with 'B'.

# OR

- (a) Define Avogadro's number. Why is it also known as Avogadro's constant?
- (b) Calculate the molar mass of Na<sub>2</sub>O.
- (c) Find the mass of 10 moles of carbon dioxide.
- 35. Draw a neat and labelled diagram to illustrate the nitrogen cycle. Mention the main steps involved in this process.
- 36. A. Explain how, the total energy of a swinging pendulum at any instant of time remains conserved. Illustrate your answer with the help of a labelled diagram.

B. A man is instructed to carry a package from the base camp at B to submit A of a hill at a height of 1200 meters. The man weighs 800 N and the package weighs 200 N. If  $g = 10 \text{ m/s}^2$ , (i) How much work does a man do against gravity? (ii) What is the potential energy of the package at A if it is assumed to be zero at B?

# Hints & Solutions

### Section-A

1. Solution: Seawater is a mixture of salts and water which cannot be separated except by evaporation. Therefore, seawater is considered homogeneous.

Seawater also contains mud, decayed plants, etc., other than salts and water, so it is heterogeneous also.

#### OR

Solution: The particle is a neutron and it is present in the nucleus of the atom.

- 2. Solution: The mole is the amount of substance that contains the same number of particles (atoms/ ions/ molecules/ formula units etc.) as there are atoms in exactly 12 g of carbon-12.
- 3. Solution: D

 $X^{\scriptscriptstyle 3+}$  indicates the loss of three electrons. Hence the remaining no. of electrons present is 10.

- 4. Solution: An example of a motion where an object does not change its speed, but its direction of motion changes continuously is the motion of the moon around the earth.
- 5. Solution: Due to the continuous change in the velocity, there is a continuous change in the direction of motion because of which the motion of a body that is moving with constant speed in a circular path is said to be accelerated
- 6. Solution: The more mass an object has, the higher is the inertia. Therefore, object B has more inertia.

## OR

The man jumping out from a moving bus possesses the inertia of motion. As the man lands on the ground, the feet come to rest immediately while the upper part of the body continues to move due to inertia of motion, and hence the person may fall forward. Hence, it is dangerous to jump out of a moving bus.

- 7. Solution: Kepler's third law of planetary motion (i.e.,  $r^3 \propto T^2$ ) led Newton to establish an inverse square rule. It was coined from the law of gravitation.
- 8. Solution: The SI unit of power is the watt (W), which is doing work at the rate of one joule per second.

9. Solution: Power of electric bulb = 60 W = 0.06 kW.

Time used, t = 6 h Energy = power × time taken = 0.06 kW × 6 h = 0.36 kW h

The energy consumed by the bulb is 0.36 kWh.

## OR

The kinetic energy of an object is given by the equation.

$$KE = \frac{1}{2}mv^2$$

Therefore,

$$KE = \frac{1}{2} \times 10 \times 2^2 = 20 J$$

- 10. Solution: (c) Ozone layer is affected by Chlorofluorocarbons which are used as refrigerants.
- 11. Solution: Genes are the hereditary units that are located on the chromosomes
- 12. Solution: Companion cells are thin-walled cells that lie on the sides of sieve tube cells.
- 13. Solution: Viruses are microorganisms that are considered intermediate between the living and the dead. Two diseases caused by viruses are Polio and AIDS.
- 14. Answer: A
- 15. Solution: (c) Cartilage has widely spaced cells, making it flexible
- 16. Answer: C

Solution: Instantaneous speed is the speed of a body at an instant. The graph of non-uniform motion is a curve with an increasing or decreasing slope.

17. Solution: (a) Eukaryotic cells have a well-defined nucleus while prokaryotic cells lack it.



(c) No, prokaryotes will not nucleoplasm as their nucleoid lies in the cytoplasm

- (d) Viruses lack cellular structure and thus have nucleic acid surrounded by a protein coat.
- 18. Solution:
  - (a) Atomic number = Number of protons = 8
  - (b) Atomic mass = Number of protons + Number of neutrons = 8 + 10= 18 u
  - (c) Valence electrons = 6
  - (d) Valency of X' = 8 6 = 2
  - (e) 'X' should be non-metal because there are six valence electrons hence it will take two more electrons to complete its outermost shell.
- 19. (a) Solution: The chemical formula of Sugar is  $C_{12}H_{22}O_{11}$ . It contains C, H, and O elements.

The chemical formula of Common salt is sodium chloride, NaCl. It contains Na and Cl elements.

- (b) Solution:
- A A sample of matter containing only one substance is called a pure substance. In other words, all constituents of the substance are the same in their chemical nature.
- A a pure substance contains only one kind of atom or molecule. It is perfectly homogenous. The two examples are Hydrogen and Sodium.
- (c) Solution:

The two types of pure substances are-

- (i) Elements- Hydrogen
- (ii) Compounds- Water
- (d) Solution: Ice, iron, hydrochloric acid, calcium oxide, and mercury are pure substances whereas milk, brick, wood, and air are impure substances.
- (e) Solution: The mixture is the other name to describe impure substances. For example- Milk and Air.
- 20. (a) Solution: For two or more bodies in an isolated system acting upon each other, their total momentum remains constant unless an external force is applied.
  - (b) Answer: B

Solution: According to the law of conservation of linear momentum, since no external force is acting on the system, the cart will move towards the right to conserve momentum.

(c) Answer: B

Solution: To conserve momentum, the cart will start moving towards the left

(d) Answer: C

Solution: When no external force acts on either body involved in a straight-line collision then the law of conservation of momentum holds true. According to the law, momentum before and after the collision is conserved so their difference will be zero.

(e) Solution: After colliding with the wall, the ball will have the same momentum since there are no external forces. To conserve momentum, however, the direction of the ball will change to be exactly opposite to its initial direction.

#### Section-B

21. Solution: Viruses do not form a cell wall or use such pathways and hence antibiotics do not work against viruses. Despite this limitation, there are no effective antiviral drugs available in the market, for example, drugs that keep HIV infection under control.



OR

- 22. Solution:
  - Ecosystem: is a self-sustaining structural and functional unit of the biosphere. It has two components - biotic (living) and abiotic (nonliving)

**b.** Biodiversity: can be defined as the various forms of animals, plants, and microorganisms found in an ecosystem.

# 23. Solution:

- 1. Both are heterogeneous mixtures.
- 2. In colloidal solution, particle size ranges between 10<sup>-9</sup> m to 10<sup>-7</sup> m whereas, in suspension, the particle size is more than 10<sup>-7</sup>m.

### OR

# Solution:

	Element		Compound
1.	An element is made up of the same kind of atoms.	1.	A compound is obtained from different kinds of atoms.
2.	An element cannot be split by physical or chemical methods.	2.	A compound can be split into new into its constituents by chemical methods.

# 24. Solution:

- (a) It states that mass can neither be created nor destroyed in a chemical reaction.
- (b) Law of constant proportion states that in a chemical compound the elements are always present in a definite proportion by mass.
- 25. Solution: The displacement of the particle is the distance is the shortest distance between its initial and final positions. In this case, the particles are back to its original position, therefore its displacement is zero.
- 26. Solution: The time required for completing one revolution for an object in a uniform circular motion can be calculated as

$$T = \frac{2\pi r}{V} = \frac{2 \times \pi \times 100}{20} = 31.4 \, s$$

#### Section-C

27. Solution: Hypotonic solutions are those solutions whose solute concentration is less than that of a cell placed in it. This results in the entry of water from the hypotonic solution to the inside of the cell by the process of endosmosis.

Hypertonic solutions are those solutions whose solute concentration is more than the solute concentration of the cell placed in it. So it results in the exit of water from the cell to the external environment by the process of exosmosis.

Isotonic solutions are those solutions whose solute concentration is exactly the same as the solute concentration of the cell placed in it. So, there is no net movement of water molecules.

# OR

Solution: AIDS or Acquired Immunodeficiency syndrome is caused by a retrovirus - HIV. This virus weakens the human body's immunity and the person having AIDS becomes prone to many other infections. This virus is transmitted through the following ways.

- 1. Sexual contact with an infected person carrying the AIDS virus.
- **2.** Transmission of blood infected with HIV
- **3.** Use of unserialized needles, blades, or razors
- **4.** Transplacental transmission is AIDS-infected mother to the fetus developing in her womb.

The important symptoms of this disease are:

- **1.** Swollen lymph nodes
- 2. Severe brain damage leads to loss of memory, ability to speak, and think.
- **3.** Low-grade fever with cough, nausea, and diarrhea.
- 4. Skin rashes that develop into ulcers
- 5. Sweating at night and weight loss
- 6. Damage to the immune system that makes AIDS patient susceptible to many diseases like pneumonia, tuberculosis, and fungal infections

# 28 Solution:

- a. Ammonification: is defined as the conversion of organic materials of plants and animals into ammonia and amino acids by microorganisms.
- b. Nitrification is defined as the conversion of ammonia into nitrates by microorganisms
- c. Denitrification is defined as the conversion of nitrate into ammonia and free nitrogen by microorganisms
- 29. Solution: Difference between xylem and phloem

Xylem	Phloem
Helps in the conduction of water and minerals from the soil to various parts of the plants through roots	Helps in the translocation of food from leaves to other parts of the plants
Made up of tracheids, vessels, xylem fibers, and xylem parenchyma, of which only xylem parenchyma is living	The makeup of sieve tubes, companion cells, phloem fibers, and phloem parenchyma of which only phloem fibers are dead.
Transportation is unidirectional or from roots to upper plants of the plant body.	Transportation is in all directions.

30. Solution:

(a) According to Newton's second law of motion, the force applied to an object is equal to the change in momentum per unit of time

$$F = \frac{m(v-u)}{t}$$

Where, m is the mass, v and u are the final and initial velocities and t is the time for which the force acts.

(b) The force on the block of metal is due to the change of momentum of water, assuming water comes to rest after meeting the block, the change in momentum of the water in one second is

$$F_w = \frac{m_w v_w}{t}$$

Now, since water releases at a rate of 1 kg/s

$$\frac{m_w}{t} = 1 \ kg/s$$

Therefore, the force of water

$$F_w = 1 \times 5 = 5 N$$

Now, this force produces an acceleration on the block, then from Newton's Second law

$$F_w = m_b a$$
  

$$5 = 2 \times a$$
  

$$a = 2.5 m/s^2$$

- 31. Solution:
  - (a) A and B are examples of isobars. Because isobars have the same number of nucleons or mass numbers but they have different numbers of protons.
  - (b) The mass numbers of A and B is 40. The relation between the two species is that they are isobars and the elements they represent are Argon and Calcium respectively.

# 32. Solution:

- (a) Atomic mass unit (amu) is 1/12 of the mass of one atom of C-12. The relative atomic mass of the atom of an element is the average mass of the atom as compared to 1/12th of the mass of the C-12 atom.
- (b) The molecular mass is expressed in units 'u' while molar mass is expressed in units 'grams'.
- 33. Solution: The acceleration due to gravity is expressed as

$$g = \frac{GM}{R^2}$$

The mass of the planet in terms can be represented as,

$$M = \rho V$$

Where  $\rho$  is the density of the planet; and V is the volume of the planet (assumed to be spherical)

$$V = \frac{4}{3}\pi R^3$$

Therefore, the value of acceleration due to gravity can be written as

$$g = \frac{G}{R^2} \times \frac{4}{3}\pi R^3 = G\frac{4}{3}\rho\pi R$$

The ratio (g<sub>1</sub>: g<sub>2</sub>)

$$\frac{g_1}{g_2} = \frac{G\frac{4}{3}\rho_1\pi R_1}{G\frac{4}{3}\rho_2\pi R_2} = \frac{\rho_1 R_1}{\rho_2 R_2}$$

#### Section-D

34. Solution: The relative atomic mass is the average mass of one of the atoms and has to take into account the relative abundances of the various isotopes.

Natural chlorine always contains about  $\frac{3}{4} \times_{17}^{35}$  Cl and  $\frac{1}{4} \times_{17}^{37}$  Cl. Therefore, relative atomic mass of chlorine =  $\frac{3}{4} \times 35 + \frac{1}{4} \times 37$ = 35.5 u

(b) Element 'A' valency +3 (left)

Element 'B' valency – 2 (right)

 $A_{+3} \sim B_{-2}^{B}$ 

Chemical formula = A<sub>2</sub>B<sub>3</sub>

## OR

# Solution:

- (a) Avogadro's number is the number of particles (atoms, ions, molecules, etc.) present in one mole of any substance. It is denoted either as NA or as NQ. The number is also called Avogadro's constant because its value is fixed ( $6.022 \times 10^{23}$ ) irrespective of the nature of the particles.
- (b) Molar mass of  $Na_2O = 2 \times Atomic mass of Na + Atomic mass of O$

= 2 x 23 u + 16 u = 62 u

- (c) Mass of 10 moles of  $CO_2 = 10 \times 44 \text{ u} = 440 \text{ u}$ .
- 35. Answer: Nitrogen fixation involves the following steps:
  - a. Conversion of atmospheric nitrogen into nitrates and nitrites by nitrogen-fixing bacteria which are found in the roots of legumes (plants that give us pulses) or during lightning in the sky.
  - b. Formation of proteins by plants and animals from nitrates.
  - **c.** On the decay and death of plants and animals, denitrifying bacteria convert the nitrates back to elemental nitrogen.



36. A. A swinging pendulum is a perfect example to show the conservation of energy. It shows the transformation of potential energy into kinetic energy and kinetic energy back into potential energy without any energy loss. In a pendulum, the law establishes that, when the ball is at its highest point, all the energy is potential energy and there is zero kinetic energy. At the ball's lowest point, all the energy in the ball is kinetic and there is zero potential energy. The total energy of the ball is the sum of the potential energy and kinetic energy.

Initially, the bob of the pendulum is at the mean position (B). When we draw the pendulum bob to one side (Extreme position A), we raise the bob to a little height and give it potential energy. This is the energy transferred by work done by hand. As at the extreme position, the bob has only PE, it tends to move down. The P.E decreases and K.E increases. At the lowest (mean) position, the bob has got K.E. Due to this it moves to the other side. Now, its K.E decreases, and P.E increases. At the extreme positions A and C, all energy is in the form of potential energy and therefore it tends to move down. Thus the bob oscillates. At all other intermediate positions, the energy of the pendulum is partly potential and partly kinetic. But, the total energy of the pendulum remains conserved.



B. (i) Weight of the man = 800N Weight of the package = 200N Total weight = 800 + 200 = 1000NHeight of the hill = 1200m $g = 10m/s^2$ Work done = mass × height × g =  $10 \times 1200 \times 1000 = 12, 00, 000 J$ or  $12 \times 10^5 J$ 

(ii) Given, Weight of the package (mg) = 200N, h = 1200m P.E = m x g x h = 200 × 1200 × 10 =  $24 \times 10^5$  J

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