

SATISH CHANDRA MEMORIAL SCHOOL
CASE-STUDY AND HOTS
CLASS IX
SCIENCE

Time Allowed: 80 MINS

Maximum Marks: 30

General Instructions:

This question paper consists of 39 questions in 3 sections. Section A is Biology; Section B is Chemistry and Section C is Physics.

(ii) All questions are compulsory. A student is expected to attempt all these questions.

(iii) Answers to the given question should be written in the specific section, answers written in a scattered manner will not be evaluated.

SECTION A – BIOLOGY

HIGHER ORDER THINKING SKILLS (HOTS)

Statement – It is observed in an experiment that few cells of a plant that was kept in dark for a long period show reduced rate of function in food production.

1. Name the cell organelle that is related to this reduced function and also state its actual biological role for the plants. (1+1)
2. Mention the name of the tissue which these cells belong to and draw the structure of that tissue with the group of cells. (1+2)

CASE STUDY – FLOATING ADAPTATION IN WATER HYACINTH

Water hyacinth is a floating aquatic plant commonly found on the surface of ponds and lakes. Its leaves and stems remain above water, while its roots remain submerged. The petioles of its leaves contain a specialized parenchymatous tissue having large air spaces. These air-filled spaces make the plant lighter and help it remain buoyant on water. The spaces also facilitate the movement of gases within different parts of the plant, especially when some parts are surrounded by water. Thus, the tissue provides structural adaptation that helps water hyacinth survive in its aquatic habitat.

3. Removal of most air spaces from the petiole of water hyacinth would primarily affect its ability to (1)
(a) transport food through phloem (b) remain buoyant on water
(c) produce seeds (d) absorb minerals through roots
4. The presence of large interconnected air spaces within the tissues of water hyacinth represents an adaptation because these spaces (1)
(a) increase the density of the plant (b) store large quantities of starch
(c) provide buoyancy and facilitate internal gas movement (d) increase the thickness of vascular bundles
5. A water hyacinth growing in a pond has well-developed air spaces in its petiole. Write the name of that particular type of parenchyma tissue developing air spaces in them. How the structural features of this tissue help the plant to survive in its aquatic habitat. (3)

SECTION B: CHEMISTRY

HIGHER ORDER THINKING SKILLS (HOTS)

1. Consider an atom of an element X having 12 protons and 12 neutrons, and an atom of an element Y having 17 protons and 18 neutrons.
- (a) Predict the chemical behavior (valency and type of ion formed) of element X and element Y based on their electronic configurations. [2]
- (b) An ion of element Z carries a net charge of -2 and contains 10 electrons and 8 neutrons. Calculate its:
(i) Atomic number (ii) Mass number
(Show your working clearly.) [2]
- (c) Rutherford's α -particle scattering experiment revealed that a very small fraction of α -particles was deflected by 180° . What key conclusion about the nucleus did this specific observation lead to? [1]

CASE-BASED STUDY

In nature, several elements occur as a mixture of different atomic species having identical atomic numbers but different mass numbers. These are termed isotopes. For example, chlorine occurs naturally in two isotopic forms with mass numbers 35 u and 37 u in a 3:1 ratio. Because isotopes share identical electronic configurations, they exhibit almost identical chemical properties, though their physical properties differ due to unequal numbers of neutrons. Furthermore, isotopes find widespread practical applications in medicine, nuclear reactors, and archaeology.

Conversely, atoms of distinct elements possessing the same mass number but different atomic numbers are known as isobars, such as Calcium (atomic number 20, mass number 40) and Argon (atomic number 18, mass number 40).

Table: Details of Five Unknown Atomic Species

1. Based on the table, which pair represents isotopes?

- (a) A and C (b) A and B (c) C and D
(d) B and D

2. What is the average atomic mass of the element represented by species A and B (occurring in a 3:1 natural abundance ratio)?

- (a) 35.0 u (b) 36.0 u (c) 35.5 u
(d) 37.0 u

3. Which pair of species in the table are isobars?

- (a) A and B (b) B and C (c) C and D (d) D and E

4. Why do isotopes of the same element exhibit identical chemical properties?

- (a) They have the same number of neutrons (b) They have the same atomic mass
(c) They have the same electronic configuration (d) They have different nuclear charges

5. An isotope of species E (Carbon with 6 protons and 8 neutrons, i.e., C-14) is primarily used in:

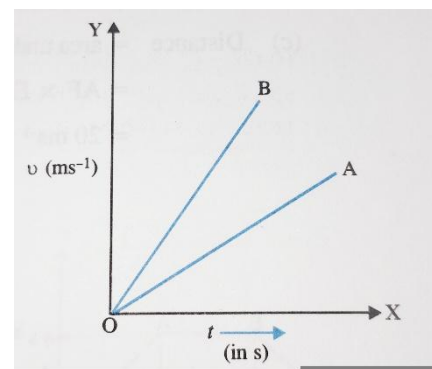
- (a) Fuel in nuclear reactors (b) Carbon dating to estimate the age of ancient fossils and artefacts
(c) Treatment of goitre (d) Radiation therapy for cancer

Species	Number of Protons	Number of Neutrons	Number of Electrons
A	17	18	17
B	17	20	17
C	18	22	18
D	20	20	20
E	6	8	6

SECTION – C: PHYSICS

HOTS

1. A ball of mass 20 g is moving with 108 km/h and comes to stop within 30 seconds.
 - (i) Find the net force acted on it.
 - (ii) Draw the position- time graph of the motion.(2+1)
2. The velocity time graph of two bodies A and B is shown in the following diagram.
 - (i) Which of the body is accelerated with greater force?
 - (ii) If the body A is moving with the acceleration of 2 m/s^2 , what is the distance after 20s?(2)



CASE STUDY QUESTION:

1. A ball of mass 25 g is moving on a road, and comes to stop after few seconds. The velocity time graph is shown in the following:

(i) The acceleration of the ball:

- (a) -2.5 m/s^2 (b) 2.5 m/s^2 (c) 10 m/s^2 (d) -10 m/s^2

(ii) How much force does the road exert on the ball to bring it to rest?

- (a) $6.25 \times 10^{-2} \text{ N}$ (b) $-6.25 \times 10^{-2} \text{ N}$ (c) $2.5 \times 10^{-2} \text{ N}$
(d) $-2.5 \times 10^{-2} \text{ N}$

(iii) The direction of force explained in the graph is :

- (a) Force exerted by the road is in the direction of motion.
(b) Force exerted by the road is in the perpendicular to direction of motion.
(c) Force exerted by the road is in the opposite direction of motion.
(d) Force exerted by the road is in the direction of motion is zero.

(iv) The change in momentum of the motion is

- (a) 0.025 kgm/s (b) 250 kgm/s (c) -250 kgm/s (d) -0.25 kgm/s

(v) The total distance travelled:

- (a) 40 m (b) 20m (c) 10m (d) 400m

