

Satish Chandra Memorial School

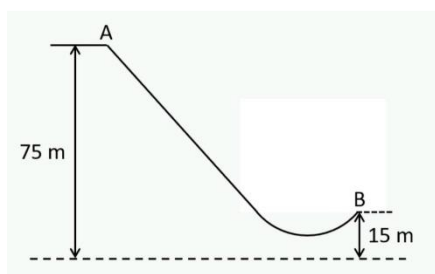
Class IX: PRACTICE TEST 2025-26: HOTS and CASE STUDY

Time: First two periods

HOTs (FM-16)- Each question@2 marks

1) A wooden cube of side 10 cm has mass 700g. What part of it remains above the water surface while floating vertically on the water surface.

2) The diagram given below shows a ski jump. A skier weighing 60kgf stands at A at the top of ski jump. He moves from A and takes off for his jump at B.



i) Calculate the change in the gravitational potential energy of the skier between A and B.

ii) If 75% of the energy in part (i) becomes the kinetic energy at B, calculate the speed at which the skier arrives at B.

3) An observer sitting in line of two tanks, watches the flashes of two tanks firing at each other at the same time, but he hears the sounds of two shots 2s and 3.5s after seeing the flashes. If distance between the two tanks is 510 m, find the speed of sound.

4) A sample of Neon is found to consist of $^{20}_{10}\text{Ne}$, $^{21}_{10}\text{Ne}$ and $^{22}_{10}\text{Ne}$ in the percentage 90.92 0.26 and 8.82 respectively. Find the average atomic mass of Neon.

5) The average atomic mass of element Z is 20.4 u. It exists as isotopes ^{20}Z and ^{22}Z . Calculate the percentage of each isotope.

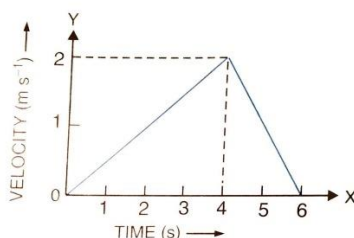
6) Write the two features as per Rutherford atomic model.

7) 'The cardiac muscles are rhythmic in contraction and relaxation and fatigueless due to their unique feature with a structural compilation similar to both striated and smooth muscles.' Justify this statement by mentioning such two dual similarities.

8) Akash jokingly claims to Asmita that we can say that Endoplasmic reticulum has two grandchildren – Lysosome and Vacuoles. Clarify the humoristic sense of Akash according to the concept of cellular organelles.

CASE STUDY (14 marks)

9) The following shows a velocity - time graph of a particle moving in straight line.



- a) State the nature of the motion of the particle from 4s to 6s. (1)
- b) Does the particle change its direction of motion? (1)
- c) Find the displacement of the particle at $t=6$ s. (1)
- d) Find the acceleration of the particle at $t=3$ s. (1)

10) Operation Smiling Buddha involved a controlled nuclear fission reaction using plutonium-239 as the fissile material. In the device, when a sufficient mass of plutonium-239 was rapidly assembled into a supercritical state, free neutrons triggered the splitting (fission) of plutonium nuclei. Each fission event released a large amount of energy according to Einstein's mass-energy relation ($E = mc^2$) and emitted additional neutrons, which sustained a chain reaction for a very brief fraction of a second. The design ensured that this chain reaction grew extremely fast but remained confined to the test environment, producing a measurable explosive yield. The successful test demonstrated India's ability to manage neutron multiplication, criticality, and energy release—core scientific principles underlying nuclear fission—using indigenous expertise.

i) The fissile material used in Operation Smiling Buddha, was

- A. Uranium-238
- B. Uranium-235
- C. Plutonium-239
- D. Thorium-232

ii) The nuclear reaction became self-sustaining when plutonium-239 was brought into a

- A. Subcritical state
- B. Radioactive decay state
- C. Supercritical state
- D. Thermonuclear state

iii) The chain reaction in the nuclear device was sustained primarily due to

- A. Continuous external neutron supply
- B. Emission of additional neutrons during fission
- C. Absorption of energy by surrounding materials

D. Fusion of lighter nuclei

iv) The energy released during the fission process is explained using

A. Newton's laws of motion

B. Coulomb's law

C. Einstein's mass–energy equivalence

D. Heisenberg's uncertainty principle

Case Study (Q. 11 to 15): Bio:

A farmer grows maize and cowpea together in alternate rows on the same field. He observes better total yield compared to growing each crop separately. The cowpea plants enrich soil nitrogen, while maize has deeper roots that absorb nutrients from lower soil layers. This reduces competition and improves overall soil fertility.

11. Based on the description, the improved total yield in this intercropping system is primarily due to which ecological principle?

A. Temporal niche differentiation, where both crops mature at different times.

B. Spatial complementarity, reducing niche overlap for nutrients and water.

C. Increased atmospheric nitrogen demand by maize, forcing cowpea to fix more nitrogen.

D. Mutualistic facilitation through mycorrhizal network sharing.

12. Considering the nitrogen-fixing capability of cowpea, what would be the most significant long-term consequence of this specific intercropping arrangement (maize + cowpea) on the soil nitrogen cycle?

A. The total nitrogen content decreases due to high consumption by both crops.

B. Nitrogen is fixed by cowpea but immobilized in the upper soil layer, making it unavailable to the deep-rooted maize.

C. It reduces the need for synthetic nitrogen fertilizers because cowpea fixes atmospheric Nitrogen while maize uses deep, stored N that legumes cannot reach.

D. The system requires increased nitrogen fertilizer because maize outcompetes cowpea for nitrogen-fixing bacteria.

13. The relationship between maize and cowpea in this case study can best be described as:

A. Competitive

B. friendly

C. Complementary

D. Parasitic

14. Which of the following changes would most likely reduce the advantage of this intercropping system?

- A. Planting maize and cowpea in alternate rows
- B. Applying excessive nitrogen fertilizer
- C. Maintaining proper spacing
- D. Using leguminous cowpea variety

15. The farmer replaced intercropping with mixed cropping of maize and cowpea, mention two disadvantages he might have to face for this change. (2)
