Model Question Paper 2

Half-Yearly Examination 2026-27

SCIENCE

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

1. This question paper has 5 sections: A, B, C, D and E.
2. Section A has 20 objective type questions carrying 1 mark each.
3. Section B has 6 questions carrying 2 marks each. Answers to these should not exceed 40-50 words each.
4. Section C has 7 questions carrying 3 marks each. Answers to these should not exceed 60-80 words each.
5. Section D has 3 questions carrying 5 marks each. Answers to these should not exceed 120 words each.
6. Section E has 3 source/case-based questions carrying 4 marks each with sub-parts.
7. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the choices in such questions.
8. Wherever necessary, neat and labelled diagrams should be drawn.

SECTION A

Question numbers 1 to 20 carry 1 mark each. Choose the most appropriate answer.

1. A student builds a small working model of the solar system to explain how planets move around the Sun, since the actual motion cannot be shown directly in a classroom. Such a simplified representation used to explain a real phenomenon is called a: *[1]*

(a) Hypothesis
(b) Model
(c) Law
(d) Random guess

2. Which of the following is the correct first step of the scientific method? *[1]*

(a) Forming a final conclusion
(b) Making careful observations and asking a question
(c) Publishing the results in a journal
(d) Testing the hypothesis with an experiment

3. The jelly-like substance that fills the interior of a cell, within which the nucleus and other organelles remain suspended, is the: *[1]*

(a) Cytoplasm
(b) Cell wall
(c) Chromoplasm
(d) Vacuole

4. Which cell organelle possesses its own DNA and is believed, according to the endosymbiotic theory, to have originated from a free-living bacterium engulfed by an early ancestral cell? *[1]*

(a) Ribosome
(b) Golgi body
(c) Mitochondria
(d) Lysosome

5. A plant cell placed in pure (distilled) water swells but does not burst, whereas a red blood cell placed in pure water swells and eventually bursts. The main reason the plant cell does not burst is that it has a: *[1]*

(a) Smaller nucleus
(b) Rigid cell wall outside the cell membrane that resists excessive swelling
(c) Thicker cell membrane only
(d) Absence of cytoplasm

6. The tissue made of long, spindle-shaped, uninucleate cells that brings about slow, involuntary movement of internal organs such as the stomach and intestines is: *[1]*

(a) Skeletal (striated) muscle
(b) Smooth (unstriated) muscle
(c) Cardiac muscle
(d) Nervous tissue

7. The tissue made up of specialised cells called neurons, responsible for carrying electrical impulses throughout the body, is: *[1]*

(a) Muscular tissue
(b) Connective tissue
(c) Nervous tissue
(d) Epithelial tissue

8. In grasses and bamboo, growth in length occurs not only at the tip but also just above each node, allowing the plant to grow taller even after the tip has stopped elongating. The dividing tissue responsible for this growth at the nodes is: *[1]*

(a) Apical meristem
(b) Lateral meristem
(c) Intercalary meristem
(d) Cork cambium

9. The physical quantity that has both magnitude and direction, and represents the shortest straight-line distance between an object's initial and final positions, is called: *[1]*

(a) Distance
(b) Speed
(c) Displacement
(d) Time period

10. A train travels 240 km in 4 hours at a constant speed. Its speed is: *[1]*

(a) 40 km/h
(b) 60 km/h
(c) 80 km/h
(d) 120 km/h

11. The velocity-time graph of an object is a straight line inclined to the time axis, showing the velocity increasing steadily. The object's motion is: *[1]*

(a) Uniform velocity
(b) Uniformly accelerated
(c) Non-uniformly accelerated
(d) At rest

12. *This question consists of two statements — Assertion (A) and Reason (R). Choose the correct option:* *[1]*

Assertion (A): The odometer fitted in a car's dashboard measures the total distance travelled, not the car's displacement.

Reason (R): Distance is a scalar quantity representing the total path length covered, whereas displacement is a vector quantity that can be zero at the end of a journey even though the distance travelled is not zero, such as in a round trip back to the starting point.

(a) Both A and R are true, and R is the correct explanation of A

(b) Both A and R are true, but R is NOT the correct explanation of A

(c) A is true, but R is false

(d) A is false, but R is true

13. Which of the following is an example of a heterogeneous mixture? *[1]*

(a) A solution of common salt in water

(b) Air

(c) A mixture of sand and water

(d) A solution of sugar in water

14. A solution in which no more of a solute can dissolve at a given temperature is called a: *[1]*

(a) Dilute solution

(b) Saturated solution

(c) Suspension

(d) Colloid

15. To separate camphor, which sublimes on heating, from a mixture with common salt, which does not, the most suitable technique is: *[1]*

(a) Filtration

(b) Sublimation

(c) Simple distillation

(d) Chromatography

16. According to Newton's first law of motion, a body at rest will remain at rest, and a body in motion will continue moving with the same velocity, unless it is acted upon by: *[1]*

(a) Its own inertia

(b) Gravity alone

(c) An unbalanced external force

(d) Friction only

17. A force of 15 N produces an acceleration of 3 m/s^2 in an object. The mass of the object is: *[1]*

(a) 3 kg

(b) 5 kg

(c) 15 kg

(d) 45 kg

18. *This question consists of two statements — Assertion (A) and Reason (R). Choose the correct option:* *[1]*

Assertion (A): It is easier to push an empty shopping cart than a fully loaded one, even when the same force is applied.

Reason (R): A body with a larger mass has greater inertia, and therefore a greater force is required to produce the same acceleration in it, as compared to a body with smaller mass.

(a) Both A and R are true, and R is the correct explanation of A
(b) Both A and R are true, but R is NOT the correct explanation of A
(c) A is true, but R is false
(d) A is false, but R is true

19. The energy possessed by a body on account of its motion is called: *[1]*

(a) Potential energy
(b) Kinetic energy
(c) Chemical energy
(d) Heat energy

20. A commercial unit of power, commonly used for rating large engines and motors, and equal to about 746 W, is the: *[1]*

(a) Watt
(b) Kilowatt
(c) Horsepower
(d) Joule per second

SECTION B

Question numbers 21 to 26 carry 2 marks each.

21. State two functions of the cell membrane. *[2]*

22. A gymnast's tendons connect her muscles to bones, while ligaments connect bone to bone at each joint. Name the connective tissues being referred to here, and state one property common to both that suits them for this role. *[2]*

23. A bus decelerates uniformly from 25 m/s to 5 m/s in 4 seconds. Calculate its retardation (deceleration). *[2]*

24. A student needs to separate a mixture of oil and water in the laboratory. Name the apparatus/technique she should use, and state the principle behind it. *[2]*

25. A force of 20 N acts on a body of mass 4 kg, initially at rest, for 5 seconds. Calculate (a) the acceleration produced, and (b) the momentum gained by the body after 5 seconds. *[2]*

26. A boy weighing 400 N climbs a vertical ladder of height 5 m in 10 seconds. Calculate (a) the work done by him, and (b) his power. *[2]*

SECTION C

Question numbers 27 to 33 carry 3 marks each.

27. A student times the swing of a pendulum five times under identical conditions and records: 2.1 s, 2.0 s, 2.2 s, 2.0 s and 2.1 s. (a) Find the mean value of the time period. (b) Explain why a single measurement is generally considered less reliable than the mean of several repeated measurements. *[3]*

28. State one difference each between a plant cell and an animal cell with respect to (a) presence of a cell wall, (b) size/presence of a vacuole, and (c) presence of plastids. *[3]*

29. List any three functions of epithelial tissue in the human body, giving one example location for each. *[3]*

30. A stone dropped from the top of a tower takes 4 seconds to reach the ground. Taking g = 10 m/s², calculate (a) the height of the tower, and (b) the velocity with which the stone strikes the ground. *[3]*

31. Name the technique used to separate two miscible liquids whose boiling points differ by more than about 25°C (for example, acetone and water), and briefly describe how it works. *[3]*

32. A ball of mass 0.5 kg moving at 10 m/s strikes a stationary ball of the same mass (0.5 kg) head-on. After the collision, the first ball comes to rest. Using the law of conservation of momentum, calculate the velocity of the second ball after the collision. *[3]*

33. State the law of conservation of energy. A ball of mass 2 kg is dropped from a height of 5 m. Taking g = 10 m/s² and ignoring air resistance, calculate its kinetic energy just before it strikes the ground. *[3]*

SECTION D

Question numbers 34 to 36 carry 5 marks each.

34. A cricket ball of mass 0.15 kg, moving at 20 m/s, is struck by a bat and rebounds along the same straight line at 25 m/s in the opposite direction. The bat remains in contact with the ball for 0.01 s. (a) Calculate the change in momentum of the ball. (b) Calculate the impulse imparted to the ball by the bat. (c) Calculate the average force exerted by the bat on the ball. (d) State Newton's third law of motion and identify the reaction force in this situation. *[5]*

OR

Two cyclists A and B start from the same point at the same time and move in the same direction along a straight road. Cyclist A moves at a constant velocity of 6 m/s throughout. Cyclist B starts from rest and accelerates uniformly at 1.5 m/s². (a) Write the expression for the distance covered by each cyclist after time t. (b) Find the time at which cyclist B catches up with cyclist A. (c) Find the distance from the starting point at which B catches up with A. (d) Who is ahead during the first few seconds, and why?

35. A machine is used to raise a load of 500 N to a height of 4 m by applying an effort of 125 N through a distance of 20 m along an inclined plane. (a) Calculate the work output (useful work done on the load). (b) Calculate the work input (work done by the effort). (c) Calculate the efficiency of the machine. (d) Explain briefly why the efficiency of a real machine is always less than 100%. *[5]*

OR

A weightlifter lifts an 80 kg barbell from the ground to a height of 2 m in 2 seconds, holds it stationary there for 3 seconds, then lowers it back to the ground in 2 seconds. Taking g = 10 m/s², calculate: (a) the work done in lifting the barbell. (b) the power developed while lifting. (c) the work done while holding it stationary for 3 seconds. (d) the work done (with sign) while lowering the barbell back down, taking upward lifting as positive work, with a brief explanation.

36. A student examines a permanent slide of the cross-section of a leaf under a microscope. She observes: an upper and lower single-layered covering with tiny pores; a layer of closely packed, column-shaped green cells just beneath the upper covering; a layer of loosely arranged green cells with air spaces beneath that; and vein-like

structures running through the middle. (a) Identify the outer covering layer and the pores present in it, and state one function of the pores. (b) Identify the closely packed, column-shaped cell layer and state its main function. (c) Identify the loosely packed layer with air spaces, and explain how its structure suits gas exchange. (d) Identify the vein-like structures, and name the two types of conducting tissue found within them. *[5]*

OR

A researcher treats two identical samples of onion peel cells under a microscope: Sample 1 with a strong sugar solution, and Sample 2 with distilled water. (a) Describe and explain the change observed in Sample 1. (b) Describe and explain the change observed in Sample 2. (c) Name the process responsible for both observations, and define it in terms of water movement across a membrane. (d) Explain why this process is important in helping a plant's stems and leaves stay firm/upright.

SECTION E

Question numbers 37 to 39 are source/case-based questions carrying 4 marks each with four sub-parts each.

Case Study 1 — Question 37 [4 Marks]

In a biology lab, students prepare a temporary mount of onion peel, staining it with iodine solution, and observe it under a compound microscope. They also observe a prepared, stained slide of human cheek cells for comparison.

(i) Why is a stain such as iodine solution or methylene blue used while preparing a temporary mount for microscopic observation? *[1]*

(ii) State two structural differences the students would observe between the onion peel cells and the human cheek cells. *[1]*

(iii) Both cell types show a dense, rounded, deeply stained structure. Name this structure and state its main function. *[1]*

(iv) Explain briefly why the discovery of the cell, and the later formulation of the cell theory (that all organisms are made of cells and that cells arise only from pre-existing cells), is considered a major milestone in biology. *[1]*

OR Both onion peel cells and cheek cells are eukaryotic. State one feature that would distinguish either of them from a bacterial (prokaryotic) cell.

Case Study 2 — Question 38 [4 Marks]

A dairy cooperative receives raw milk that sometimes carries dust or dirt collected during milking, so it is passed through a fine cloth strainer before processing. To train new lab technicians in classifying mixtures, the cooperative also has them compare milk (itself a mixture) with a sugar solution and a chalk-water mixture.

(i) Name the process used to remove visible dirt/dust particles from raw milk using a cloth strainer. *[1]*

(ii) Milk is classified as a colloid rather than a true solution or a suspension. State one property of milk that supports this classification. *[1]*

(iii) A chalk-water mixture settles at the bottom on standing, unlike milk. Identify the type of mixture chalk-water represents, and name the process by which the settled chalk can be separated from the water above it. *[1]*

(iv) When a beam of light is passed through sugar solution, milk, and the chalk-water mixture in a dark room, each behaves differently. Describe what would be observed in each case, relating it to the particle size in each mixture. *[1]*

OR Suggest one everyday example, seen in nature or daily life, of the Tyndall effect that milk exhibits.

Case Study 3 — Question 39 [4 Marks]

During a school sports day, a 50 kg athlete runs up a staircase of vertical height 6 m in 5 seconds during a 'stair-climb' event. Later, on the playground, the same athlete balances a see-saw (a simple lever) with a younger, lighter child, and the sports teacher uses both events to explain work, energy and simple machines.

(i) Define power, and state its SI unit. *[1]*

(ii) Calculate the work done by the athlete against gravity while climbing the staircase. (Take $g = 10\ m/s^2$.) *[1]*

(iii) Calculate the power developed by the athlete during the climb. *[1]*

(iv) On the see-saw, the heavier athlete sits closer to the pivot than the lighter child, in order to balance it. Using the principle of moments for a lever, explain why sitting closer to the pivot allows a heavier person to balance a lighter person sitting farther away. *[1]*

OR If the athlete's weight is 500 N and she sits 1 m from the pivot, how far from the pivot, on the other side, should a child weighing 250 N sit to balance the see-saw?