Grade 9 Optional Science Model Paper 3

MODEL PAPER

Full marks 75 · 2.25 hours

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 75

All questions are compulsory. Time: 2.25 hours.

A practice paper by Science Playground, made to CDC's Specification Grid 2076, Science (Optional); not an official CDC or exam board paper. Mark it yourself online: the QR code below opens the paper with its answers.

A full practice run of the Optional Science paper: 75 marks in 2 hours 15 minutes, 39 questions, every one compulsory, in four sections. Section A asks for very short answers (1 mark each), Section B short answers (2 marks), Section C answers of 3 marks and Section D long answers (4 marks). Write your answers on paper as in the exam hall, then open each answer and give yourself the marks its scheme allows.

Section A

16 × 1 = 16

1. Write very short answers to the following questions.

a. Name the cell organelle that has no membrane and makes proteins.

b. By which method does yeast reproduce asexually?

c. Who is called the father of genetics?

d. What is a wetland?

e. What is phagocytosis?

f. What is the largest number of electrons the M shell can hold?

g. What is absolute zero?

h. What is the degree of ionization of an electrolyte?

i. What is a functional group?

j. What is a catalyst?

k. What is impulse?

l. What is a beta particle?

m. State Snell's law.

n. Define capacitance.

o. What is the magnetic meridian?

p. What is a lahar?

Section B

13 × 2 = 26

Write short answers to the following questions.

2. Write any two differences between the cell wall and the cell membrane. **[2]**

3. Write any two differences between binary fission in *E. coli* and budding in yeast. **[2]**

4. Write any two differences between hereditary variation and environmental variation. **[2]**

5. Write any two differences between a vaccine and an antibiotic. **[2]**

6. The relative atomic mass of chlorine is 35.5, not a whole number. Why? **[2]**

7. Write any two differences between a real gas and an ideal gas. **[2]**

8. Write any two differences between organic and inorganic compounds. **[2]**

9. When a thermometer breaks in the laboratory, the spilled mercury is covered with sulphur powder. Why? Write the equation. **[2]**

10. Write any two differences between the moment of a force and a couple. **[2]**

11. In a magnetic field, alpha particles and beta particles bend in opposite directions, and alpha particles bend much less. Why? **[2]**

12. An optical fiber carries light along its bends with almost no loss. Why? **[2]**

13. Two magnetic lines of force never cross each other. Why? **[2]**

14. Write any two differences between the P waves and the S waves of an earthquake. **[2]**

Section C

7 × 3 = 21

Answer the following questions.

15. Take two cube-shaped cells, one 1 µm on each side and the other 10 µm. Calculate the ratio of surface area to volume of each, and use it to explain why cells are small. **[3]**

16. A single bacteriophage infects a culture of bacteria. Each lytic cycle takes 30 minutes and releases 150 new phages from each infected cell. If every new phage infects a fresh bacterium, how many phages will there be after 1 hour? **[3]**

17. Boron has two isotopes, of masses 10 u and 11 u. Its average atomic mass is 10.8 u. Calculate the percentage of each isotope in natural boron. **[3]**

18. Copper sulphate solution is electrolysed using carbon electrodes. **[3]**

i. Write the reactions at the cathode and the anode. (2)

ii. The blue color of the solution slowly fades. Why? (1)

19. A transparent plastic has a refractive index of 1.6. Find its critical angle in air. Will a ray inside the plastic that meets its surface at an angle of incidence of 45° come out into the air? (sin 38.7° = 0.625) **[3]**

20. A 220 µF capacitor is connected to a 9 V battery until it is fully charged. Calculate the charge on either plate and the number of extra electrons on its negative plate. (Charge of an electron = 1.6×10^{-19} C) **[3]**

21. The Gorkha earthquake of 2015 had a magnitude of 7.8, and the Jajarkot earthquake of 2023 a magnitude of 5.7. How many times larger were the Gorkha earthquake's waves, and how many times more energy did it release? **[3]**

Section D

3 × 4 = 12

Write long answers to the following questions.

22. In the 1990s the vultures of Nepal fell by more than nine tenths. The cause was diclofenac, a painkiller given to sick cattle, which harms a vulture's kidneys when it eats a treated carcass. **[4]**

i. Diclofenac did not harm the cattle, and only a small share of carcasses contained it. Suggest why it could still kill most of the vultures. (1)

ii. Alina says, "Vultures are only scavengers. Bacteria and fungi decompose carcasses anyway, so losing the vultures does not matter." Do you agree? Give two reasons, following the effects through the ecosystem. (2)

iii. Nepal banned diclofenac for animals in 2006 and set up "vulture restaurants", where carcasses of cattle kept free of the drug are left out. If the vultures recover, predict what will happen to the number of stray dogs, and explain why. (1)

23. Two compounds, P and Q, both have the molecular formula C_2H_6O. When a small piece of sodium is added to P, hydrogen gas is given off. Q does not react with sodium. **[4]**

i. Identify P and Q. Write the condensed formula and the name of each, and explain how the sodium test tells them apart. (2)

ii. One of them boils at 78 °C and the other at −25 °C. Which is which? Explain from their structures. (1)

iii. Sabin says, "P and Q have the same formula, so they must have the same properties." Explain why Sabin is wrong, and name compounds like P and Q. (1)

24. A bus of mass 4,000 kg moving east at 10 m/s collides head-on with a car of mass 1,000 kg moving west at 15 m/s. They stick together after the collision. **[4]**

i. Find the total momentum before the collision. (1)

ii. Find their common velocity just after the collision. (1)

iii. By how much does the velocity of the car change? (1)

iv. The people in the car are hurt much more than those in the bus. Explain why. (1)