S2 Science Practice Paper: Cells and Reproduction, Matter and Separation Techniques, Force and Motion, Light and Sound, Electricity and Magnetism, Earth and Space

S2 | Science | Time: 60 minutes | Total: 100 marks | 24 questions

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Part 1: Cells and Reproduction (17 marks)

Answer in complete sentences and spell scientific terms correctly.

1. State the main function of the nucleus, the cell membrane and the chloroplast. [4]

Answer: The nucleus controls cell activities and stores genetic material; the cell membrane controls the movement of substances into and out of the cell; the chloroplast carries out photosynthesis.

2. List three main differences between a plant cell and an animal cell. [4]

Answer: Plant cells have a cell wall, chloroplasts and a large central vacuole, while animal cells do not have a cell wall or chloroplasts and have no large vacuole.

3. Compare sexual reproduction with asexual reproduction and give one example of each. [4]

Answer: Sexual reproduction involves the fusion of gametes and produces variation, for example humans; asexual reproduction produces offspring from one parent, for example a potato tuber.

4. Tongue rolling (T) is dominant to non-rolling (t). If both parents are Tt, find the ratio of rolling to non-rolling offspring. [5]

Answer: The cross Tt x Tt gives genotypes TT : Tt : tt = 1 : 2 : 1, so rolling : non-rolling = 3 : 1.

Part 2: Matter and Separation Techniques (17 marks)

For classification items write only the category; show working for calculations.

5. Classify air, water and oxygen as element, compound or mixture. [4]

Answer: Air is a mixture, water is a compound and oxygen is an element.

6. Choose a suitable separation method for each mixture: sand and water, salt and water, coloured dyes, ethanol and water. [4]

Answer: Sand and water: filtration; salt and water: evaporation or distillation; coloured dyes: chromatography; ethanol and water: fractional distillation.

7. At 20 degrees C, 100 g of water dissolves at most 36 g of salt. If 50 g of salt is added to 100 g of water, find the mass of undissolved salt and describe the solution. [4]

Answer: Only 36 g dissolves, so 50 - 36 = 14 g remains undissolved and the solution is saturated.

8. Use the particle model to explain why a metal rod expands slightly when heated. [5]

Answer: On heating the particles gain energy and vibrate more strongly, so the average spacing between particles increases and the rod expands slightly.

Part 3: Force and Motion (17 marks)

Write the formula, substitution and unit for each calculation.

9. Explain why a standing passenger leans forward when a bus brakes suddenly. [4]

Answer: By inertia the passenger keeps moving forward while the bus slows down, so the upper body continues forward and the passenger leans forward.

10. A 2 kg object experiences a net force of 10 N. Find its acceleration and its weight on Earth (take g = 10 N/kg). [4]

Answer: a = F/m = 10/2 = 5 m/s^2, and W = mg = 2 x 10 = 20 N.

11. State one advantage of friction and two ways of reducing friction. [4]

Answer: Advantage: friction gives grip so we can walk or stop a vehicle. Reducing friction: add lubricant, use ball bearings or polish the surfaces.

12. A movable pulley lifts a load of 300 N. Ignoring friction, find the effort needed; if the actual effort is 200 N, find the efficiency. [5]

Answer: The ideal effort is 300/2 = 150 N, so the efficiency is 150/200 x 100% = 75%.

Part 4: Light and Sound (17 marks)

Use a ruler for ray diagrams and give units with numerical answers.

13. Use the rectilinear propagation of light to explain the formation of a shadow. [4]

Answer: Light travels in straight lines; an opaque object blocks the light, so the region behind it that receives no light forms a shadow.

14. State the law of reflection and give three properties of the image formed by a plane mirror. [4]

Answer: The angle of incidence equals the angle of reflection and the rays lie in one plane with the normal; the image is virtual, the same size as the object and laterally inverted.

15. When light passes from air into water at an angle, does it bend towards or away from the normal? Explain. [4]

Answer: Light travels more slowly in water, so the refracted ray bends towards the normal.

16. Thunder is heard 3 seconds after a flash of lightning. Taking the speed of sound in air as 340 m/s, estimate the distance of the lightning and say why the travel time of light is ignored. [5]

Answer: Distance = 340 x 3 = 1020 m, about 1.0 km; light travels at about 3 x 10^8 m/s, so its travel time is negligible.

Part 5: Electricity and Magnetism (17 marks)

Write the formula for each circuit calculation and use standard circuit symbols.

17. Compare series and parallel circuits in terms of current and voltage. [4]

Answer: In a series circuit the current is the same everywhere and the voltages add up; in a parallel circuit the voltage is the same across each branch and the branch currents add up.

18. A 3 ohm resistor is connected across a 6 V battery. Find the current. If a 6 ohm resistor is added in series, find the new current (ignore internal resistance). [4]

Answer: I = V/R = 6/3 = 2 A; the total resistance becomes 9 ohm, so the new current is 6/9, about 0.67 A.

19. Write the relation between power, voltage and current, and state the function of a fuse. [4]

Answer: P = VI; a fuse melts and breaks the circuit when the current is too large, preventing overheating and fire.

20. Give three ways to strengthen an electromagnet and one application of electromagnets. [5]

Answer: Increase the current, increase the number of turns and insert an iron core; applications include electric bells, lifting magnets and door locks.

Part 6: Earth and Space (15 marks)

One mark per valid point; keep answers relevant to the question.

21. Name the three main layers of the Earth. [3]

Answer: Crust, mantle and core (inner core and outer core).

22. Which natural phenomena are caused by plate movement? Give two and explain briefly. [4]

Answer: Earthquakes: rocks at plate boundaries break suddenly and release energy; volcanoes: sinking plates melt and magma rises (or mountains: plates collide and crush the crust).

23. Name the first four of the eight planets in order from the Sun and give two conditions that make Earth suitable for life. [4]

Answer: Mercury, Venus, Earth, Mars; conditions include liquid water, a suitable temperature range and an oxygen-containing atmosphere (any two).

24. Give one renewable and one non-renewable energy source, and one way to reduce air pollution. [4]

Answer: Renewable: solar (or wind, hydro); non-renewable: coal (or oil, natural gas); reducing pollution: use public transport, use renewable energy or install filters.
