S3 Science Practice Paper (Set 2)

S3 | Science | Time: 60 minutes | Total: 100 marks | 24 questions

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Part 1: Neutralisation and pH (18 marks)

Show the working, the substitution and the unit in every answer.

1. Hydrochloric acid of 0.20 M is used to neutralise 25.0 cm3 of 0.10 M sodium hydroxide solution. Find (a) the number of moles of sodium hydroxide, and (b) the volume of hydrochloric acid needed in cm3.

2. A solution has pH 3. (a) Find its hydrogen ion concentration. (b) Find the new pH after the solution is diluted 100 times.

3. 20.0 cm3 of 0.15 M sulfuric acid is neutralised by 0.30 M sodium hydroxide solution. Find the volume of sodium hydroxide solution needed.

4. Rain sample A has pH 4.0 and sample B has pH 5.5. How many times greater is the hydrogen ion concentration of A than that of B?

Part 2: Electric Heating and Electricity Cost (17 marks)

Show the formula and the unit; electricity costs $1.20 per kWh.

5. An electric kettle rated at 2,000 W runs for 15 minutes for each boil. Find the energy used per boil in kWh.

6. Using the previous result, find the monthly energy use and the monthly cost if the kettle is used once a day for 30 days.

7. A current of 3 A passes through a 20 ohm resistor for 5 minutes. Find (a) the power, and (b) the heat produced in kJ.

8. An appliance rated at 220 V, 1,500 W is protected by a fuse. Find the operating current and choose the most suitable fuse from 5 A, 10 A and 13 A, giving a reason.

Part 3: Sound Waves (16 marks)

Take the speed of sound in air as 340 m/s and the speed of light as 3.0 x 10^8 m/s.

9. A sound has a frequency of 170 Hz. Find its wavelength.

10. A student shouts towards a cliff and hears the echo 2.4 s later. Find the distance to the cliff.

11. A tuning fork vibrates 500 times per second. Find (a) the frequency, and (b) the period.

12. Thunder is heard 3.0 s after the lightning is seen. Find the distance to the strike and explain why the travel time of light can be ignored.

Part 4: Reflection, Refraction and Colour (17 marks)

Show the working; all angles are measured from the normal.

13. A ray hits a plane mirror with an angle of incidence of 35 degrees. Find (a) the angle of reflection, and (b) the angle between the incident ray and the reflected ray.

14. Light enters glass from air with an angle of incidence of 30 degrees and refracts at 19 degrees. Find the refractive index of the glass.

15. A 3 cm pencil stands 12 cm in front of a plane mirror. Find (a) the image distance from the mirror, (b) the distance between object and image, and (c) the image height.

16. White light is dispersed by a prism. (a) Which colour is deviated most? (b) What colour does blue paper appear under red light? Explain.

Part 5: Solar System, Earth Movement and Moon Phases (16 marks)

Show the working; take the mean orbital radius of the Earth as 1.5 x 10^11 m.

17. Two places differ in longitude by 45 degrees. Find the time difference between them.

18. One lunar cycle from new moon to new moon takes about 29.5 days. Find the average number of days between two consecutive principal phases.

19. The Earth orbits the Sun in 365.25 days. Estimate the mean orbital speed in m/s.

20. A year is taken as 365.25 days. (a) How many days are there in four years? (b) What conditions are necessary for a solar eclipse?

Part 6: Classification, Food Chains and Microscopic Measurement (16 marks)

Show the working; relative atomic masses: C = 12, O = 16.

21. Producers in a food chain fix 50,000 kJ of energy. If only 10% of the energy passes to the next trophic level, find the energy at the primary, secondary and tertiary consumer levels.

22. List the seven main levels of biological classification from largest to smallest, and state the two parts of a binomial name.

23. Photosynthesis absorbs 264 g of carbon dioxide. Find (a) the number of moles of carbon dioxide, and (b) the mass of oxygen produced at the same time.

24. Cells are viewed through a 10x eyepiece and a 40x objective. A cell measures 20 mm on the micrograph. Find (a) the total magnification, and (b) the actual length of the cell in micrometres.
