S2 Integrated Science Practice Paper (Set 2) | Density and floating, pressure and hydraulics, series and parallel circuits, heat capacity, refraction and energy pyramid

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

Question 1 Density and Floating

Show the formula and all working in each part.

1. A wooden block has mass 240 g and volume 300 cm3. Find its density. (2 marks)

2. Will the block float or sink in water? Explain your answer. (3 marks)

3. A metal piece has mass 54 g and volume 20 cm3. Find its density and state whether it floats in water. (5 marks)

4. An object of volume 200 cm3 is fully immersed in water. Find the upthrust on it, take g = 10 N/kg. (6 marks)

Question 2 Pressure and Hydraulic Jack

Write down the formula and state the unit in each part.

5. A box weighs 300 N and touches the floor over an area of 0.5 m2. Find the pressure on the floor. (3 marks)

6. If the same box is placed on its side with contact area 0.15 m2, find the new pressure. (4 marks)

7. What is the water pressure at a depth of 3 m? (density of water 1000 kg/m3, g = 10 N/kg) (4 marks)

8. A hydraulic jack has a small piston of area 5 cm2 with a force of 50 N; the large piston has area 200 cm2. Find the pressure transmitted and the force on the large piston. (5 marks)

Question 3 Series and Parallel Circuits

Show the formula; give current in A and voltage in V.

9. A 12 ohm resistor is connected to a 6 V supply. Find the current. (4 marks)

10. Resistors of 4 ohm and 6 ohm are in series with a 12 V supply. Find the total resistance, the current and the voltage across the 4 ohm resistor. (5 marks)

11. Resistors of 6 ohm and 12 ohm are in parallel across a 12 V supply. Find the equivalent resistance, the total current and the current in the 12 ohm resistor. (5 marks)

12. The parallel circuit runs for 5 minutes (300 s). Find the power and the electrical energy used. (4 marks)

Question 4 Heat and Specific Heat Capacity

Take the specific heat capacity of water as 4200 J/(kg C) and of aluminium as 900 J/(kg C).

13. How much heat is needed to raise 2 kg of water from 20 C to 50 C? (5 marks)

14. A 0.5 kg aluminium block absorbs 4500 J of heat. Find its temperature rise. (4 marks)

15. 200 g of water at 80 C is mixed with 300 g of water at 20 C. Assuming no heat loss, find the final temperature. (5 marks)

16. Explain why coastal areas have a smaller day-night temperature range than inland areas. (3 marks)

Question 5 Magnification, Refraction and Critical Angle

Take the speed of light as 3 x 10^8 m/s and the refractive index of glass as 1.5.

17. An object is 6 mm high and its image is 24 mm high. Find the magnification. (4 marks)

18. The Moon is 384 000 km from the Earth. How long does light take to travel from the Moon to the Earth? (4 marks)

19. Light enters glass of refractive index 1.5 from air at an angle of incidence of 45 degree (sin 45 = 0.707). Find the angle of refraction. (5 marks)

20. Find the critical angle for light travelling from glass (n = 1.5) to air. (3 marks)

Question 6 Energy Pyramid in an Ecosystem

Assume only 10% of the energy is passed to the next trophic level.

21. Producers fix 40 000 kJ of energy. Find the energy available to primary consumers. (3 marks)

22. Continue to find the energy available to secondary and tertiary consumers. (4 marks)

23. Find the energy lost as heat between producers and primary consumers, and its percentage. (5 marks)

24. Explain why food chains usually have no more than four to five trophic levels. (5 marks)