S4 Physics Practice Paper: Force and Motion, Work Energy and Power, Momentum and Collisions, Waves and Sound, Light and Refraction, Electricity and Circuits (100 marks)

S4 | Physics | Time: 60 minutes | Total: 100 marks | 24 questions

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Part A: Force and Motion (16 marks)

Write the formula, substitute the values and give the unit.

1. A car starts from rest and accelerates uniformly at 2 m/s2. What is its velocity after 5 seconds? [4]

2. In the same motion, what distance does the car travel in 5 seconds? [4]

3. A body of mass 4 kg experiences a net force of 12 N. What is its acceleration? [4]

4. A stone falls freely from a height of 45 m (take g = 10 m/s2, ignore air resistance). Find the time of fall and the velocity on landing. [4]

Part B: Work, Energy and Power (16 marks)

Power is measured in watts (W).

5. A force of 20 N pushes a body through 5 m along the direction of the force. How much work is done? [4]

6. A body of mass 2 kg moves at 6 m/s. What is its kinetic energy? [4]

7. A body of mass 5 kg is lifted steadily through 3 m (take g = 10 m/s2). By how much does its gravitational potential energy increase? [4]

8. A machine does 600 J of work in 20 seconds. What is its average power? [4]

Part C: Momentum and Collisions (17 marks)

Take the rightward direction as positive.

9. A ball of mass 0.5 kg moves to the right at 8 m/s. What is its momentum? [4]

10. A body of mass 2 kg moving at 3 m/s collides with a stationary body of mass 1 kg. They stick together after the collision. Find their common velocity. [4]

11. A force of 200 N acts on a ball of mass 0.2 kg for 0.05 s. Find the impulse and the change in velocity of the ball. [4]

12. Two bodies of 0.5 kg each move towards each other along the same horizontal line at 4 m/s (right) and 2 m/s (left). They stick together after the collision. Find the total momentum, the common velocity, and the kinetic energy lost. [5]

Part D: Waves and Sound (17 marks)

Take the speed of sound in air as 340 m/s.

13. A wave has frequency 50 Hz and wavelength 4 m. What is its speed? [4]

14. A wave has a frequency of 250 Hz. What is its period in seconds? [4]

15. A person shouts towards a wall and hears the echo 0.6 s later. How far is he from the wall? [4]

16. 20 crests pass a point in 0.5 s. Find the frequency and the period; if the wave speed is 340 m/s, find the wavelength. [5]

Part E: Light and Refraction (17 marks)

Take the refractive index of water as 1.33 and of glass as 1.5.

17. A ray of light enters water from air at an angle of incidence of 30 degrees. Find the angle of refraction (sin 30 degrees = 0.5). [4]

18. Light travels from glass to air. Find the critical angle (give the answer to one decimal place). [4]

19. The speed of light in a vacuum is 3.0 x 10^8 m/s. Find the speed of light in glass of refractive index 1.5. [4]

20. A pool is 2 m deep. How deep does the bottom appear when viewed from directly above the surface? Also, an object is placed 3 m in front of a plane mirror; what is the distance between the object and its image? [5]

Part F: Electricity and Circuits (17 marks)

Resistance is measured in ohms and voltage in volts.

21. A current of 0.5 A flows through a resistor of 6 ohms. What is the voltage across it? [4]

22. Resistors of 4 ohms and 6 ohms are connected in series to a 12 V supply. Find the current and the voltage across the 6 ohm resistor. [4]

23. A 6 ohm resistor and a 3 ohm resistor are connected in parallel. What is the equivalent resistance? [4]

24. A current of 0.5 A flows through a resistor of 24 ohms. Find its power and the energy it uses in 10 minutes. [5]