# S6 Physics Practice Paper: Mechanics and Motion, Circular Motion and Gravitation, Waves and Optics, Electricity and Magnetism, Thermal Physics, Atomic and Nuclear Physics

S6 | Physics | Time: 75 minutes | Total: 100 marks | 24 questions

## Part 1 Mechanics and Motion

**State the formula and unit used; take g = 9.81 m/s2.**

**1. A car accelerates uniformly from rest at 2.5 m/s2 for 8 s. Find (a) the final speed and (b) the distance travelled.** [4]

**2. A stone is released from rest at a height of 45 m with air resistance ignored. Find the time of fall and the speed on landing.** [4]

**3. A box of mass 3.5 kg is pushed horizontally with 20 N while friction acts with 6 N. Find the acceleration of the box.** [4]

**4. A ball of mass 0.25 kg hits a wall at 12 m/s and rebounds at 9 m/s, contact time 0.05 s. Find the change in momentum and the average force from the wall.** [4]

## Part 2 Circular Motion and Gravitation

**Take G = 6.67 x 10-11 N m2/kg2 and the mass of the Earth as 5.97 x 1024 kg.**

**5. An object moves uniformly on a circle of radius 0.8 m with period 0.4 s. Find the linear speed and the centripetal acceleration.** [4]

**6. A satellite orbits the Earth in a circular orbit of radius 7.0e+06 m. Find its orbital speed and period.** [4]

**7. An astronaut of mass 60 kg stands on the Moon (g = 1.62 m/s2) and on the Earth. Find the weight in both places and explain whether the mass changes.** [5]

**8. A car turns on a level road with radius 50 m. The maximum coefficient of static friction is 0.6. Find the maximum safe speed.** [4]

## Part 3 Waves and Optics

**Take the speed of sound as 340 m/s; angles are measured from the normal.**

**9. A sound wave has frequency 512 Hz and travels at 340 m/s in air. Find the wavelength and state how it changes if the frequency doubles.** [4]

**10. In a double-slit experiment the slit separation is 0.5 mm, the screen is 2 m away and the third bright fringe is 7.2 mm from the centre. Find the wavelength.** [4]

**11. Light passes from air (n = 1.0) into glass of n = 1.5 at an angle of incidence of 45 degrees. Find the angle of refraction.** [4]

**12. An object is placed 45 cm in front of a convex lens of focal length 15 cm. Find the image distance, the magnification and the nature of the image.** [5]

## Part 4 Electricity and Magnetism

**State the formulas; use W for power and J for energy.**

**13. 6 ohm and 12 ohm in parallel are joined in series with 4 ohm across a 12 V supply. Find the total resistance and the total current.** [4]

**14. A charge of 2e-06 C sits in a uniform field of 5e+04 V/m. Find the force on it and the work done by the field when it moves 0.2 m along the field.** [4]

**15. A 20 ohm resistor carries 0.5 A for 5 minutes. Find the energy dissipated and the power.** [4]

**16. An ideal transformer has 2400 primary turns and 120 secondary turns, a primary voltage of 240 V and a secondary current of 5.0 A. Find the secondary voltage and primary current.** [5]

## Part 5 Thermal Physics

**Take the specific heat capacity of water as 4200 J/(kg K) and the specific latent heat of fusion of ice as 3.34 x 105 J/kg.**

**17. 0.5 kg of water is heated from 20 C to 80 C. Find the heat required.** [4]

**18. 2 kg of water is heated from 20 C to 100 C by a 1500 W heater with no heat loss. Find the time needed.** [4]

**19. 0.2 kg of ice at 0 C melts completely to water at 0 C. Find the heat absorbed and explain why the temperature does not change during melting.** [4]

**20. An ideal gas at 300 K and 1.0e+05 Pa occupies 2.0e-03 m3. It is heated at constant pressure to 450 K. Find the new volume.** [5]

## Part 6 Atomic and Nuclear Physics

**Take h = 6.63 x 10-34 J s, c = 3.0 x 108 m/s, 1 eV = 1.6 x 10-19 J and 1 u = 931.5 MeV.**

**21. A photon has a wavelength of 500 nm. Find its energy in J and in eV.** [4]

**22. A metal has a work function of 2.0 eV and is illuminated by the photons above. Find the maximum kinetic energy of the photoelectrons and state whether emission occurs.** [4]

**23. A radionuclide has a half-life of 5 days and currently contains 8.0e+20 nuclei. Find the number remaining after 15 days.** [4]

**24. A nuclear reaction has a mass defect of 0.002 u. Find the energy released in MeV and in J.** [4]

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