S6 Physics Practice Paper (Set 2)

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

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Part A Circular Motion and Centripetal Force (12 marks)

A ball of mass 0.20 kg tied to a 0.50 m string moves in a horizontal circle on a smooth table with a period of 0.80 s.

1. Find the angular velocity of the ball. (3 marks)

2. Find the linear speed of the ball. (3 marks)

3. Find the centripetal acceleration. (3 marks)

4. Find the tension in the string. (3 marks)

Part B Gravity and Satellite Orbits (18 marks)

The mass of the Earth is 5.97 x 10^24 kg and its radius is 6.37 x 10^6 m; G = 6.67 x 10^-11 N m² kg^-2. A satellite moves in a circular orbit of radius 7.00 x 10^6 m.

5. Find the acceleration due to gravity at the Earth surface. (4 marks)

6. Find the orbital speed of the satellite. (5 marks)

7. Find the period of the satellite in minutes. (5 marks)

8. If the orbital radius is doubled, find the new orbital speed. (4 marks)

Part C Simple Harmonic Motion (16 marks)

A 0.50 kg mass on a smooth horizontal surface is attached to a spring of force constant 20 N/m and oscillates with amplitude 0.080 m.

9. Find the angular frequency and the period. (4 marks)

10. Find the frequency of oscillation. (4 marks)

11. Find the maximum speed and the maximum acceleration. (4 marks)

12. Find the total mechanical energy of the oscillation. (4 marks)

Part D Gas Laws and Kinetic Theory (18 marks)

An ideal gas at 300 K occupies 2.0 x 10^-3 m³ at a pressure of 1.0 x 10^5 Pa. Its molar mass is 0.032 kg/mol; R = 8.31 J mol^-1 K^-1 and k = 1.38 x 10^-23 J K^-1.

13. Find the number of moles of the gas. (4 marks)

14. Heated at constant pressure to 450 K, find the new volume. (4 marks)

15. Find the root-mean-square speed of the molecules at 300 K. (5 marks)

16. Find the mean translational kinetic energy of one molecule. (5 marks)

Part E Photoelectric Effect (18 marks)

The work function of sodium is 2.28 eV. Light of wavelength 400 nm is incident on a sodium surface; h = 6.63 x 10^-34 J s, c = 3.0 x 10^8 m/s and e = 1.602 x 10^-19 C.

17. Find the energy of one incident photon in eV. (5 marks)

18. Find the maximum kinetic energy of the photoelectrons. (4 marks)

19. Find the stopping potential. (4 marks)

20. Find the threshold wavelength. (5 marks)

Part F Radioactive Decay and Half-life (18 marks)

A radioactive source has a half-life of 8.0 days and an initial activity of 6400 Bq.

21. Find the decay constant in day^-1 and in s^-1. (4 marks)

22. Find the activity after 24 days. (4 marks)

23. How long does the activity take to fall to 640 Bq? (5 marks)

24. Find the number of nuclei present initially. (5 marks)
