S4 Physics Practice Paper 1 | kinematics, forces, momentum, circuits and specific heat

Senior Secondary Physics

S4 Physics practice paper with answers: kinematics equations, Newton second law with friction, work and energy, momentum and collisions, circuits, specific heat capacity.

1. Uniformly accelerated motion and graphs (16 marks)

Take g = 10 m s^-2 and give answers to one decimal place unless stated.

#	Question
1	(a) A car starts from rest and accelerates uniformly at 2.5 m s^-2 for 8 s. Find the velocity at the end of 8 s and the displacement in that time.
2	(b) A car travelling at 15 m/s brakes uniformly and stops in 40 m. Find the acceleration and the braking time.
3	(c) A ball falls freely from a 45 m platform, ignoring air resistance. Find the time of fall and the speed on landing.
4	(d) State what the gradient of a displacement-time graph and the gradient of a velocity-time graph represent, and explain the meaning of the area under a velocity-time graph.

2. Newton second law and friction (18 marks)

Take g = 10 m s^-2 and show the force analysis.

#	Question
5	(a) An 8 kg object on a horizontal surface is pulled by a 36 N horizontal force against 12 N of friction. Find its acceleration.
6	(b) A 5 kg object slides down a frictionless 30 degree incline. Find its acceleration; if friction on the incline is 6 N, find the new acceleration.
7	(c) A 60 kg person stands on a scale in a lift. What does the scale read when the lift accelerates upward at 2 m/s^2, and when it accelerates downward at 2 m/s^2?
8	(d) Use inertia to explain why a passenger lurches forward when a car brakes sharply, and state the function of a seat belt.

3. Work, energy and power (16 marks)

Take g = 10 m s^-2 and give units.

#	Question
9	(a) A 50 N horizontal force moves an object 12 m in 8 s. Find the work done and the average power.
10	(b) A 2 kg ball falls freely from 5 m. Find its speed on reaching the ground, ignoring air resistance.
11	(c) A machine takes in 2,500 J and is 80 per cent efficient. Find the useful output and the energy wasted as heat and sound.

#	Question
12	(d) Explain why mechanical energy is not conserved when a body slides down a real incline, and state where the energy goes.

4. Momentum and collisions (18 marks)

Give momentum in kg m s^-1 and energy in joules.

#	Question
13	(a) A car of mass 1,200 kg travels at 15 m/s. Find its momentum.
14	(b) A 0.5 kg clay ball at 4 m/s hits a stationary 1.5 kg block and sticks to it. Find the common velocity and the kinetic energy lost.
15	(c) An athlete of mass 60 kg holds a 4 kg rifle and fires a 0.02 kg bullet horizontally at 400 m/s. Find the recoil speed of the athlete.
16	(d) Use impulse F t = change in momentum to explain how an airbag reduces injury in a crash.

5. Ohm law, series and parallel circuits, power (16 marks)

Give currents to one decimal place and power as whole numbers.

#	Question
17	(a) A 12 V supply is connected to 4 ohm and 6 ohm resistors in series. Find the total resistance, the current and the voltage across each resistor.
18	(b) The same 12 V supply is now connected to the two resistors in parallel. Find the equivalent resistance, the total current and the current in each branch.
19	(c) An electric kettle is rated 220 V, 2,000 W. Find the current; if it is used for half an hour, find the energy used in kWh and the cost at 1.2 dollars per kWh.
20	(d) State one feature each of series and parallel circuits and explain why household appliances are connected in parallel.

6. Specific heat capacity and latent heat (16 marks)

Take the specific heat capacity of water as 4,200 J kg^-1 K^-1 and the latent heat of fusion of ice as 3.34 x 10^5 J kg^-1.

#	Question
21	(a) How much energy is needed to heat 2 kg of water from 20 C to 70 C?
22	(b) A 1,500 W heater with no heat loss is used on the same 2 kg of water. How many seconds are needed?
23	(c) How much energy is needed to melt 0.5 kg of ice at 0 C completely and then warm the water to 20 C?
24	(d) 0.3 kg of water at 80 C is mixed with 0.5 kg of water at 20 C, with no heat loss. Find the final temperature.