S5 Physics Practice Paper 1 | Uniform acceleration, Newton s second law, power, resistors, refraction

Senior Secondary Physics

S5 Physics practice paper with answers: acceleration, Newton s second law and friction, work energy and power, resistors, refraction, heat capacity and gas laws.

1. Uniform acceleration and v-t graphs (16 marks)

Show working throughout; take g = 10 m/s^2.

#	Question	Answer and marking notes
1	(a) A car accelerates uniformly from rest to 20 m/s in 8 s. Find the acceleration.	a = 20 / 8 = 2.5 m/s^2.
2	(b) The car then travels at a steady 20 m/s for 12 s. Find the distance covered.	s = 20 x 12 = 240 m.
3	(c) The car then decelerates uniformly at 4 m/s^2 until it stops. Find the braking time and braking distance.	t = 20 / 4 = 5 s; s = 20^2 / (2 x 4) = 50 m.
4	(d) Find the average speed over the whole journey (accelerating, steady, braking).	Total distance 80 + 240 + 50 = 370 m, total time 8 + 12 + 5 = 25 s; average speed = 370 / 25 = 14.8 m/s.

2. Force and Newton s second law (18 marks)

Show working throughout; show steps in (d).

#	Question	Answer and marking notes
5	(a) A resultant force of 15 N acts on a 5 kg body. Find the acceleration.	a = F / m = 15 / 5 = 3 m/s^2.
6	(b) A lift of mass 800 kg accelerates upwards at 1.5 m/s^2. Find the tension in the cable.	T = m(g + a) = 800 x (10 + 1.5) = 9,200 N.
7	(c) A 20 kg crate rests on horizontal ground; the coefficient of kinetic friction is 0.25. Find the friction force.	f = mu x m x g = 0.25 x 20 x 10 = 50 N.
8	(d) A horizontal push of 90 N is now applied to the crate. Find its acceleration and its speed 4 s after starting from rest.	Net force = 90 - 50 = 40 N; a = 40 / 20 = 2 m/s^2; v = u + a t = 0 + 2 x 4 = 8 m/s.

3. Work, energy conservation and power (16 marks)

Show working throughout.

#	Question	Answer and marking notes
9	(a) A horizontal force of 60 N moves a crate 5 m in the direction of the force. Find the work done.	W = F s = 60 x 5 = 300 J.

#	Question	Answer and marking notes
10	(b) A 2 kg body falls freely from a height of 5 m; ignore air resistance. Find its speed on landing.	m g h = 1/2 m v^2, so v = sqrt(2 x 10 x 5) = 10 m/s.
11	(c) A pump raises 300 kg of water through 8 m every minute. Find its average output power.	P = m g h / t = 300 x 10 x 8 / 60 = 400 W.
12	(d) A motor has an input power of 500 W and an efficiency of 80%. Find its output power.	P = 500 x 80% = 400 W.

4. Resistors in series and parallel, and power (18 marks)

Show working; give resistance to 2 decimal places.

#	Question	Answer and marking notes
13	(a) Resistors of 4 ohm and 8 ohm are connected in series to a 12 V supply. Find the total resistance and the current.	R = 4 + 8 = 12 ohm; I = 12 / 12 = 1 A.
14	(b) Find the voltage across the 8 ohm resistor and the power dissipated in it.	V = I R = 1 x 8 = 8 V; P = I^2 R = 1^2 x 8 = 8 W.
15	(c) The same two resistors are reconnected in parallel to the 12 V supply. Find the total resistance and total current.	R = 4 x 8 / (4 + 8) = 2.67 ohm; I = 12 / 2.67 = 4.5 A.
16	(d) Find the total power in the parallel case and the percentage increase over the series case.	Parallel P = 12 x 4.5 = 54 W; series P = 12 x 1 = 12 W; increase = (54 - 12) / 12 x 100% = 350%.

5. Wave speed, frequency and refraction (16 marks)

Show working; give angles to 1 decimal place.

#	Question	Answer and marking notes
17	(a) Sound travels in air at 340 m/s with a frequency of 170 Hz. Find the wavelength.	lambda = v / f = 340 / 170 = 2 m.
18	(b) Find the period of this sound wave in milliseconds (1 decimal place).	T = 1 / 170 = 0.00588 s, about 5.9 ms.
19	(c) Light passes from air into glass, slowing from 3.0 x 10^8 m/s to 2.0 x 10^8 m/s. Find the refractive index, and the angle of refraction for an angle of incidence of 45 degrees.	n = 3.0 / 2.0 = 1.5; sin r = sin 45 / 1.5 = 0.4714, r = 28.1 degrees.
20	(d) Water waves travel from deep water (0.40 m/s) into shallow water (0.24 m/s) with an angle of incidence of 30 degrees. Find the angle of refraction.	sin r = (0.24 / 0.40) x sin 30 = 0.30, r = 17.5 degrees.

6. Heat capacity and gas laws (16 marks)

Take the specific heat capacity of water as 4200 J kg^-1 K^-1; show working throughout.

#	Question	Answer and marking notes
21	(a) 2 kg of water is heated from 20 C to 60 C. Find the energy required.	E = m c dT = 2 x 4200 x 40 = 336,000 J (3.36 x 10^5 J).
22	(b) A 1,000 W heater of efficiency 84% is used. Find the time required.	t = 336,000 / (1,000 x 0.84) = 400 s.
23	(c) A fixed mass of gas is compressed at constant temperature from 2.0 L to 0.5 L; its original pressure is 100 kPa. Find the new pressure.	P1 V1 = P2 V2, so P2 = 100 x 2.0 / 0.5 = 400 kPa.
24	(d) At constant pressure, a gas of volume 3.0 L at 27 C is heated to 327 C. Find the new volume.	V1 / T1 = V2 / T2, so V2 = 3.0 x 600 / 300 = 6.0 L.