

Q	Answer Key	Suggested Explanation
1	B	Displacement is a vector, while charge is a scalar.
2	B	Distance travelled = area under graph $3 = \frac{1}{2} (5.0) (\text{time})$ Time = 1.20 s
3	D	Velocity decreases, hence gradient of displacement time graph decreases.
4	A	For angle between the forces = 0° , Resultant force = $3.0 + 4.0 \text{ N} = 7.0 \text{ N}$ For angle between the forces = 90° , resultant force = 5.0 N (Pythagoras theorem). Hence, we expect the resultant force to be between 5.0 N and 7.0 N .
5	C	By newton's 3 rd law, force = 4200 N on the propeller due to the air upwards.
6	B	Total mass = $450 + 240 = 690 \text{ g}$ Total volume = $450/9 + 240/8 = 80 \text{ cm}^3$ Effective density = $690 / 80 = 8.63 \text{ g/cm}^3$
7	A	Taking moments about P, $(50)(0.5) = (S)(1.0)$ $S = 25 \text{ N}$
8	C	Now, the C.G. is at Y. Later on, when more sand is added, the C.G. goes up vertically from Y towards X.
9	C	$P = W / t = mgh / t$ $= (2.0)(10)(50) / 4.0 = 25 \text{ W}$
10	A	Constant volume $\rightarrow$ same average distance apart Cooled $\rightarrow$ temperature decreases $\rightarrow$ average speed decreases
11	B	Convection current cannot reach the bread as heated less dense air will not sink down.
12	B	$E = P t = I V t = (33)(200)(4.0 \times 3600) = 95 \text{ MJ}$ Useful energy = $0.90 \times 95 \text{ MJ} = 86 \text{ MJ}$
13	B	Pressure at Y = Pressure at X $250/40 = F/10$ $F = 62.5 \text{ N}$
14	D	Factual recall (from X to the vacuum on top, 80 cm).
15	B	Factual recall (higher temperature, larger average KE of air molecules, more frequent and more forceful collisions with smoke particles by air molecules).
16	C	Factual recall.
17	D	Heating at A or cooling at C will result in the downward convection current at point P.
18	D	$\text{KE} = \frac{1}{2} m v^2 = \frac{1}{2} (4.0) (1.5^2) = 4.50 \text{ J}$ Total work done = KE converted + work done against friction = $4.5 + (1.0)(1.0) = 5.5 \text{ J}$ $W = Fd = 5.5 = (F)(1.0)$ $F = 5.5 \text{ N}$
19	A	Plastic is a poor conductor of heat. Vacuum stops conduction and convection.
20	D	The white inner surface (wrapped around athlete) reflects IR from athlete back to athlete so that athlete cools down more slowly. [past year O-level paper, 2022]
21	B	Internal energy increases as the average kinetic energy of molecules increases.
22	D	4 wavelengths between P and Q $\rightarrow$ distance PQ is 8.0 m Speed of wave = $d/t = 8.0 / 10 = 0.80 \text{ m/s}$ Time to travel $30 \text{ m} = 30 / 0.80 = 37.5 \text{ s}$
23	B	Same frequency due to same source G is moving downwards from its max (peak) position so its speed is increasing H is going to move upwards
24	C	Cannot see cannot see 2 and 3 Can see 1, 5, 4

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25	A	Angle of incidence = $90 - 33 = 57^\circ$ $\sin(57) / \sin(r) = 1.5$ $r = 34^\circ$ $n = 1 / \sin C = 1.5 \rightarrow C = 42^\circ$
26	C	Factual recall.
27	D	R is infrared radiation. It is used in television remote controller.
28	B	Glass rod loses electrons to silk and hence becomes positively charged. There are more protons than electrons on glass rod.
29	B	p.d. across 1 resistor = $9 / 3 = 3.0 \text{ V}$ $W = VQ = (3)(2) = 6.0 \text{ J}$
30	B	For the same p.d. across, $R = V / I$ Half the current means twice the resistance. Length / Area = $8.0 / 25 = 0.32$. New length / area = $0.32 \times 2 = 0.64$
31	C	Highest output when R is high and resistance of LDR is low (bright)
32	D	PQ: $12/7 = 1.71 \Omega$ QR: $33/14 = 2.36 \Omega$ RS: $20/7 = 2.86 \Omega$ SP: $45/14 = 3.21 \Omega$
33	C	1A flows through the 8Ω that is in parallel. $V = IR = 1.0 \times 8 = 8.0 \text{ V}$
34	D	Factual recall. Earth wire is now connected to the live terminal, so the metal case is live.
35	B	Factual recall
36	A	Iron is a soft magnetic material which gains and loses magnetism easily.
37	C	Apply Fleming's Left Hand Rule (on positive charges to the left)
38	A	p.d. at secondary coil = $4/1 \times 2.5 = 10 \text{ V}$ lamp Q will experience a 10 V across it. It will be much brighter since the p.d. is higher than rated.
39	B	Factual recall. A is not correct as the decay is not a linear process (count-rate versus time is not linear)
40	C	81 protons, 124 neutrons There are no electrons in the nucleus. Electrons orbit around the nucleus. There are 43 more neutrons than protons in the nucleus.