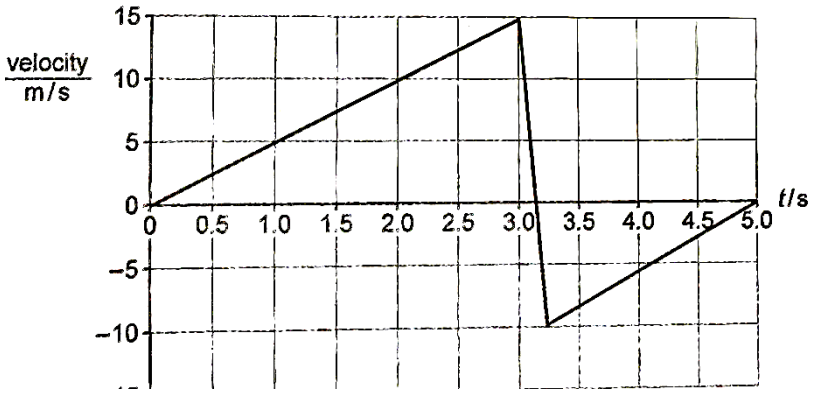
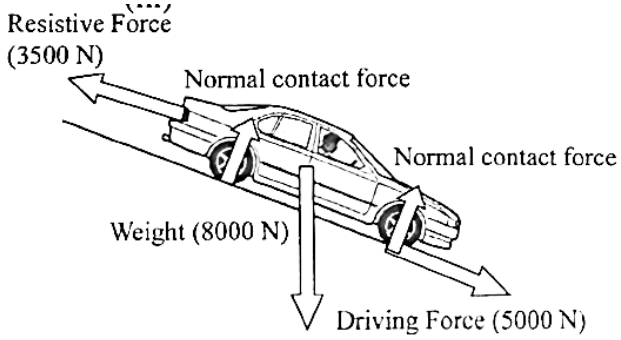
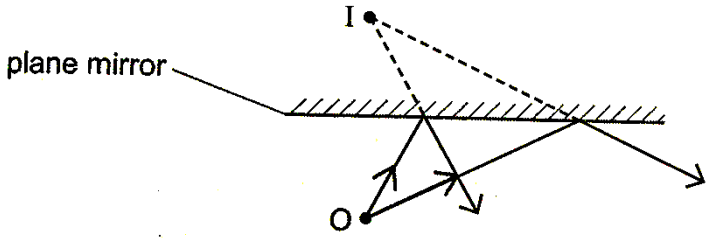
Question Number	Key	Question Number	Key	Question Number	Key	Question Number	Key
1	B	11	B	21	D	31	C
2	A	12	D	22	B	32	D
3	C	13	D	23	C	33	A
4	B	14	D	24	B	34	B
5	D	15	B	25	C	35	C
6	A	16	D	26	A	36	A
7	B	17	B	27	D	37	D
8	A	18	D	28	C	38	A
9	C	19	C	29	D	39	C
10	A	20	B	30	B	40	D

Paper 2 Section A

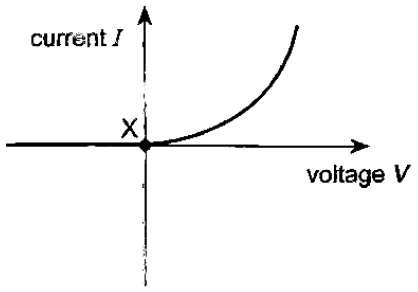
Qn	Answer	Comments
1(a)	10 m/s^2	B1 CAO
1(b)(i)	Speed should be **30 m/s after 3.0 s** with g = 10 m/s^2 but with a speed of 15 m/s after 3.0 s indicate the presence of air resistance decreasing the rate of change of speed.	B1 Must use data.
1(b)(ii)	 Constant acceleration (straight line) from 0 to 15 for first 3.0 s [1] Ball hits floor and in contact for 0.2 s(3.2 s) [1] From -10 m/s to 0 m/s at 5.0 s [1] gradient should be the same as previous line.	[1]
1(c)	The area of the velocity- time graph **between t = 0 s and t = 3.0 s** would give the height.	B1

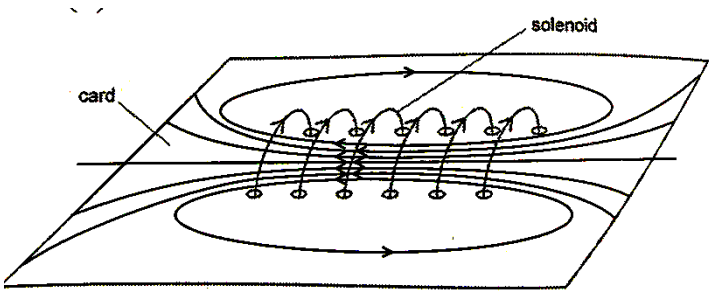
Qn	Answer	Comments
2(a)	Inertia (depends on mass only)	
2(b) i	5000 N [1] to the left acting on the road from the car [1]	
ii	F = ma F = 5000 – 3500 = 1500 1500 = ma a = 1500 / 800 = **<u>1.9 m/s^2</u>(2sf)**	 C1 B1
iii		
3(a)	2.0 cm^2 = 2.0 x 10^{-4} m^2 Pressure = Force / area = 60 / (2.0 x 10^{-4}) Pressure = **<u>3.0 x 10^5 Pa</u>**	 C1 B1
3(b)	**Oil is an incompressible liquid**, hence pressure from piston P is transmitted to piston Q. **Piston Q has a wider area than piston P**, hence with the same pressure, force at piston Q will be smaller.	B1 B1
3(c)i	**Strong internal forces** between molecules of oil as well as **closely packed molecules** make it difficult for molecules to be compressed.	B1 B1 Must describe structure rather than motion.
3(c)ii	Some of the energy will be loss to compress the bubbles of air.	B1

Qn	Answer	Comments
4(a)i	Work done = force x distance Force = work done / distance Force = 1.6 x 10^5 / 210 = **760 N** (2sf)	 C1 B1
4(a)ii	Speed = distance / time = 210 / 150 = 1.4 m/s $E_k = ½ mv^2$ = ½ x 160 x (1.4)(1.4) = 156.8 = **160 J** (2sf)	 C1 B1
4(b)	<table><tr><th>Non- renewable</th><th>renewable</th></tr><tr><td>nuclear fuel fossil fuels</td><td>biofuel hydropower geothermal wind</td></tr></table>	B1 for non-renewable B1 for renewable
5(a)	v = λ × f λ = v / f = 3.0 x 10^8 / 2.5 x 10^9 = **0.12 m**	 C1 B1
5(b)i	Radio waves | infrared | ultraviolet	B1
5(b)ii	In remote controllers to control equipment/appliances Intruder alarms / thermal imaging	 B1
5(b)iii	Artificial tanning in sunbeds / bank note authentications / disinfecting water/ surgical equipment	B1
5(c)i	High power radio waves can cause heating of the skin / body tissues, which can cause burns	B1
5(c)ii	High frequency electromagnetic radiation at low powers can have high ionising effect and can damage cells. Long term exposure may cause cancer.	B1 B1
6(a)i		[1] for correct rays [1] for correct position of image
6(a)ii	The image of the can be obtained by first extending or extrapolating the 2 ray of reflections behind the mirror as virtual rays. The point of intersection between the 2 extended will lie the image.	B1

Qn	Answer	Comments
6(b)	Time between pulses = 1/8 = 0.125 s Max distance = ½ (speed x time) = ½ (320 x 0.125) = **<u>20 m</u>**	B1 C1 B1
7(a)	total resistance in parallel = $(\frac{1}{48+12} + \frac{1}{30})^{-1}$ = 20 Ω Total resistance in circuit = 100 Ω + 20 Ω = **<u>120 Ω</u>**	C1 B1
7(b)i	Current in circuit = 9.0 / 120 = 0.075 A p.d. across 100 Ω resistor = 0.075 x 100 = 7.5 V p.d. between A and B = 9.0 – 7.5 = **<u>1.5 V</u>**	C1 B1
7(b)ii	P = IV = 0.075 x 7.5 = 0.5625 W = **<u>0.56 W</u>**	C1 B1
8(a)	When **current goes beyond 7.0 A**, the **greater the current, the shorter the time before the fuse melt.**	B1
8(b)i	Standard fuse: Less than 1.0 s from table 0.99 s correspond to 12 A, hence half the current rating would be **<u>6.0 A</u>**.	B1
8(b)ii	Fast blow fuse: 0.1 s would be **<u>0.09 s from table correspond to 40 A; hence half the current rating would be 20 A</u>**. If its fuse current rating is 6.0 A, it would allow **too much current to flow before the fuse melt** which may **cause damage/overheating (resulting in fires) to equipment.**	B1 B1
8(c)i	$P = I^2R$, $E = Pt = I^2Rt = (30)^2(0.015)(0.16)$ = 2.16 J = **<u>2.2 J (2sf)</u>**	C1 B1
8(c)ii	Energy dissipated = 9.6 – 2.16 = 7.44 J or **<u>7.4 J (2sf)</u>**	C1
8(c)iii	Conduction – within the wires into the 2 metal terminals/connectors at both ends of the fuse Radiation – throughout the fuse including sealed glass cylinder and, in all direction. **OR** Convection – in the air inside the glass cylinder	B1 B1
(c)iv	30A – **No change in time** as no energy is loss to the surrounding. All energy is used to melt fuse. Same as before. 8A – **Time taken will be shorter** as heat transfer through convection cannot take place in a vacuum hence no heat loss to the surroundings and **more heat is used to melt fuse**.	B1 B1

Qn	Answer	Comments
9(a)i	**Alpha particles can be stopped by a piece of paper**. The table shows **a drop emission by 100 with a piece of paper**.	B1
9(a) ii	**Beta particles can be stopped, (500 to 0 count) by (5mm) a thin sheet of Aluminum** as can be seen from table when it is used as an absorber.	B1
9(a)iii	**Gamma radiation cannot be stopped by either paper or aluminum** as it is transmitted through EM waves. From the table, **count rate per min. remains at 0, hence no evidence of gamma radiation is observed.**	B1
9(b)i	Natural occurring radiation from space or from environment (such as the soil in the ground or from equipment)	B1
9(b)ii	It can be measured by placing **a detector (radiation) in the open, unobstructed and away from any known radioactive source**	B1
9(c)i	**53 protons**, **53 electrons** and 131 – 53 = **78 neutrons**	B1 B1
9(c)ii	Half-life is the time taken for **half the nuclei of the nuclei of a sample to decay.**	B1
9(c)iii	Half-life – 8.0 days 360 -> 180 -> 90 -> 45 Takes 3 half-lives for count rate to decrease to 45. Time taken = 8.0 x 3 = **<u>24 days</u>**	 B1 B1

Qn	Answer	Comments
10(a)	**Iron is a of a soft magnetic material** which can be **magnetised and demagnetised easily** (direction of magnetic field too).	B1
10(b)	$\frac{N_s}{N_p} = \frac{V_s}{V_p}$, $N_s = \frac{V_s}{V_p} \times N_p$	
	Minimum number if turns at 12 V: $N_s = \frac{12}{6.0} \times 14 = \mathbf{28\ turns}$	B1
	Maximum number of turns at 24 V: $N_s = \frac{24}{6.0} \times 14 = \mathbf{56\ turns}$	B1
10(c)	An **alternating current produces changing magnetic field around the primary coil and hence a consistent change in magnetic flux linkage with the secondary coil i**nducing an emf in the secondary coil.	B1
10(d)i		B1 – curve B1 - positive
10(d)ii	When diode is connected, **current can only flow in the circuit when the voltage is positive**, since **current only flows only in 1 direction it is d.c.**	B1
10(e)	**Step-up transformer** is used after the power station and generator stage to **increase the output voltage** and so as to **decrease the output current** before relaying into the transmission line to **reduce power loss** (Power loss = I^2R). At the end of the transmission lines, **step-down transformers** are used to **decrease the voltage to a safe level** (240 V)for home, office and industries use.	B1 B1 B1 B1

Qn	Answer	Comments
11(a)		B1 – correct pattern B1 – right format – arrows, not touching each other, arrows correct direction
11(b)i	When **current is turned on**, both rods will be magnetised by the magnetic fields from the coil. **Both rods will be magnetised with the same polarity at both ends**.	B1
	Since **liked poles repel**, the **two rods will move away from each other.**	B1
11(b)ii	When the current is removed, the **iron rod which is a made of soft magnetic material will lose its magnetism** but **steel being a hard magnetic material will retain its magnetic field for some time attracting the non-magnetised iron rod.**	B1 B1
11(c)i	Current in neutral – **5 A** Current in earth – **0 A**	B1
11(c)ii	When live wires touches the metal case, the **circuit is complete with the low resistance earth wire.**	B1
	This **increases the current in the circuit, strengthening the magnetic field of the solenoid on the Live wire and thus the electromagnet.**	B1
	This exerts a strong enough attractive force on the iron rod, **attracting the rod resulting in a clockwise rotation, pushing up the contacts causing them to be separated.**	B1 B1
	Circuit now is open current stops flowing.	