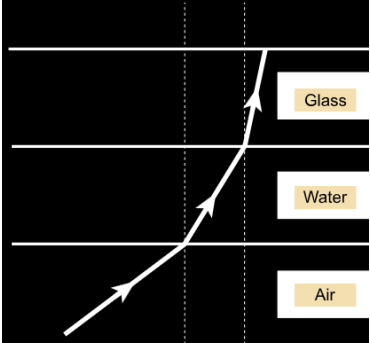


Question		Answers	Notes	Marks	Criterion
1	a	50 (km h ⁻¹)		1	A
	b	<p>any two reasonable suggestions, for example</p> <ul style="list-style-type: none"> • head wind • drag • different weather systems such as rain • increasing fatigue or other physiological feature as they fly • behavioural flight patterns eg flying in groups 		2	A
	c	diagram 4		1	A
	d	<p>force: between points C and D the retarding force is increasing or forces are no longer balanced</p> <p>speed: reducing to <u>zero</u></p> <p>acceleration: deceleration / retardation / negative acceleration</p> <p>Newton's law: second law or quoting F=ma</p>	ECF from 1 st marking point for marking points 2, 3 and 4	4	C
	e	(20*120*0.5) or 1200 or 1.2 m or km	Unit to agree with numerical value	2	C
2	a	<p>labels in order from top to bottom: wavelength – amplitude – compression - rarefaction</p> <p>any two labels correct</p> <p>all labels correct</p>		2	A
	b	12 (Hz)		1	C
	c	A and B		1	C
	d	6 waves in 1 second or f = 6 Hz (wavelength = $\frac{330}{6}$ =) <u>55 m</u>	Unit required for 2 nd mark Award one mark only for correct wavelength without unit	2	C
	e	wave D		1	C

	f	<p>identification of <u>diffraction</u></p> <p>general explanation of diffraction</p> <p>how diffraction relates to the specific situation</p>		3	A
3	a	<p>Draggable items</p>  <p>air correctly identified</p> <p>water and glass correctly identified</p>		2	A
	b	<p>light refracts or changes direction or bends (when it changes medium)</p> <p>degree to which it refracts is dependent on change in density of the medium</p> <p>or</p> <p>degree to which it refracts is dependent on the relative change in the refractive index of the materials</p> <p>or</p> <p>degree to which it refracts is dependent on the change in its speed</p> <p>(because) the ray bends towards the <u>normal</u> as it slows down</p>	<p><i>WTTE but there must be an implied change in medium for marking point 2</i></p> <p>ORA</p>	3	A

4	a	<table border="1"> <thead> <tr> <th></th> <th>Charge</th> </tr> </thead> <tbody> <tr> <td>Electron</td> <td>-1</td> </tr> <tr> <td>Proton</td> <td>+1</td> </tr> <tr> <td>Neutron</td> <td>0</td> </tr> </tbody> </table>		Charge	Electron	-1	Proton	+1	Neutron	0		1	A
			Charge										
		Electron	-1										
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b	<p><u>electrons</u> are the only particle which can move</p> <p>electrons are transferred</p> <p>(so) a lack of electrons creates a positive charge</p>	Accept "negative charge in place of electron" for marks 2 and 3	3	A									
c	<p>cat is charged by rubbing the carpet</p> <p>pellets are uncharged</p> <p>reference to the charge on the cat inducing or causing or creating an opposite charge in the pellets</p> <p>the charge on the cat is attracted to the electrons/protons/opposite charges in the pellets or the pellets are then attracted to the cat</p>		4	A									
5	a	<p>conduction</p> <p>convection</p> <p>radiation</p>		3	A								
	b	<p>any reasonable suggestion of equipment, for example</p> <ul style="list-style-type: none"> • timer • balance <p>correctly linked justification</p>	Do not accept ice or paper	2	B								
	c	<p>statement of prediction that links number of sheets of <u>paper</u> and <u>mass</u> of ice that has melted, for example</p> <p>mass of ice melted decreases as number of sheets of paper increases</p> <p>correctly linked justification, for example</p> <p>number of sheets of paper is increasing gives more insulation which reduces mass of ice that melts</p>		2	B								

	d	statement of reasonable variable statement of how the variable should be controlled justification of why the variable should be controlled		3	B
	e	indication of how mass lost will be determined collect at least five sets of data repeat each set at least three times and average		3	B
6	a	(not supported because) as the thickness increases the time taken to cool down follows no trend or 2 mm coffee cup was the slowest to cool down		1	C
	b	Four weaknesses and correctly linked scientific explanation of the effect of each weakness, for example different thicknesses of cup were used different materials were used which will have different thermal conductivities different coloured materials were used different coloured materials will radiate thermal energy / heat differently volume was not the same each time filling to the same height does not give the same volume as the dimensions are different the cups were of different dimensions the surface area exposed to the air was different for each cup the room temperature was not measured the room temperature may not have been controlled or could have varied	Accept answers relating to number of trials even though this is a procedural weakness	8	C

7	a	IV – thickness of aluminium sheet DV – amount / intensity of beta radiation absorbed or that penetrates		2	B
	b	electron (that is) high-energy or fast-moving		2	A
	c	as the thickness of the aluminium sheet increases the intensity of the beta radiation that penetrates the sheet decreases as the aluminium sheet is made thicker the electrons would have less chance of penetrating due to more energy loss or increased interaction or collisions with atoms	ORA	2	B
	d	Four points describing the method given below <ul style="list-style-type: none"> • at least five conditions of the independent variable • measurements repeated at least three times or counts averaged • count rate measured with no aluminium between source and GM tube • measurements taken with aluminium sheets of increasing number between source and GM tube Any two further reasonable points, for example <ul style="list-style-type: none"> • control variable e.g. distance/orientation between source and GM tube should be fixed • aluminium sheets of the same thickness • same source should be used for each test 		6	B
	e	Any reasonable source of background radiation, for example <ul style="list-style-type: none"> • cosmic rays • rocks • fallout from nuclear testing 		1	A
	f	background radiation should be measured without the presence of the beta source background count should be deducted from all future measurements		2	B

	g	any two reasonable precautions and correctly related reason, for example															
		<table border="1"> <thead> <tr> <th>Precaution</th> <th>Reason</th> </tr> </thead> <tbody> <tr> <td>minimize time of exposure</td> <td>reduce dose because exposure~time</td> </tr> <tr> <td>increase distance between source and person or use tongs</td> <td>reduce dose because exposure~1/distance</td> </tr> <tr> <td>shielding/protective clothing</td> <td>reduce dose because radiation is absorbed by shielding</td> </tr> <tr> <td>avoid pregnant women</td> <td>reduce risk of genetic abnormality</td> </tr> <tr> <td>do not point source towards body</td> <td>reduce dose because β radiation is directional</td> </tr> </tbody> </table>	Precaution	Reason	minimize time of exposure	reduce dose because exposure~time	increase distance between source and person or use tongs	reduce dose because exposure~1/distance	shielding/protective clothing	reduce dose because radiation is absorbed by shielding	avoid pregnant women	reduce risk of genetic abnormality	do not point source towards body	reduce dose because β radiation is directional	<i>Do not accept gloves or goggles</i>	4	B
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	h	<p>hypothesis alpha particles would be stopped completely by the first aluminium sheet</p> <p>explanation alpha particles are less penetrating than beta particles or alpha particles have higher mass and have more interaction with matter than beta</p>		2	B												
8	a	<p>six times identified</p> <p>values ranging between 0 and 100</p> <p>equally spaced values</p> <p>two averages calculated correctly</p> <p>all correct</p> <p>averages expressed as whole numbers</p>	<i>Award the sig fig marks for any number correctly expressed</i>	6	C												
	b	smooth curve		1	C												

	c	one half life correctly read from graph two further half lives calculated correct calculation of average		3	C
	d	4 half lives 8 years	<i>Award only one mark for four years</i>	2	A
9	a	<i>Any two reasonable suggestions, for example</i> <ul style="list-style-type: none"> • pollution from smoke • unsightly • noisy operation • large lorries delivering coal 	<i>Do not accept "dangerous"</i>	2	D
	b	large quantity of water is required for cooling or large quantity of water is required to turn turbines or large quantity of water is required to generate steam	<i>Do not accept "use water to dispose of nuclear waste"</i>	1	D
	c	(the secondary current) halves		1	A
	d	energy loss is proportional to size of the current increasing the voltage reduces the current less heat is generated (so less energy is lost)	<i>WTTE</i>	3	D

10	a	any reasonable application requiring a constant source of electricity			1	D
	b	<ul style="list-style-type: none"> incomplete statement of reason for constant source of electricity with no reference to application in 10a advantage or disadvantage stated with no reference to 10a 	1–2		15	D
		<ul style="list-style-type: none"> reason for a constant source of electricity related to application in 10a is stated advantage and disadvantage related to 10a is stated an impact on society or an economic impact 	3–5			
		<ul style="list-style-type: none"> reason for a constant source of electricity in application in 10a is clearly explained advantage outlined disadvantage outlined an impact on society and an economic impact 	6–9			
		<ul style="list-style-type: none"> reason for a constant source of electricity in application in 10a is clearly explained and justified advantage explained in detail disadvantage explained in detail a clearly reasoned impact on society a clearly reasoned economic impact a concluding appraisal 	10–15			