



# **GCSE MARKING SCHEME**

**SCIENCE - PHYSICS (LEGACY)**

**SUMMER 2012**

## **INTRODUCTION**

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - PHYSICS (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

**PHYSICS 1 (LEGACY)**

**FOUNDATION TIER**

Question		Marking details	Marks Available
1.	(a) (b)	Totally internally reflected (1) ...more than... (1) refracted (1) ..... less than.... (1)  <b>Question total</b>	4  <b>[4]</b>
2.	(a) (b) (c)	<u>Complete</u> orbit drawn <u>nearer</u> the Earth's than to Saturn's. (i) Jupiter, Uranus, or Neptune (ii) Saturn is further from [the Sun] or Earth is closer. (i) A collection of <u>rocks</u> [with sizes smaller than that of the smallest planet] in <u>an orbit</u> (1) <u>around the Sun</u> between the orbits of Mars and Jupiter (1) [could credit in (c)(i)] (ii)  <b>Question total</b>	1 1 1 2  <b>[5]</b>
3.	(a) (b)	(i) Conduction (1) (ii) Convection (1)  (b) Glass fibre is a good insulator / traps air (1) reduces heat loss / keeps <u>more</u> heat in (1)  <b>Question total</b>	2 2  <b>[4]</b>
4.		(i) Reduces heat / energy loss in the cables / not much voltage drop in the cables (1) (ii) Step-down <u>transformers</u> (1) (iii) To give a consistent / reliable supply [to everyone] / support for breakdowns etc (1)  <b>Question total</b>	3  <b>[3]</b>
5.	(a) (b)	[CO <sub>2</sub> produces] global warming / greenhouse effect (1) [SO <sub>2</sub> produces] acid rain (1)  (i) Cooling required / prevents overheating / to produce steam (1) (ii) Transport of coal / fuel / removal of waste (1)  <b>Question total</b>	2 2  <b>[4]</b>

**Physics 1 (Legacy) Foundation Tier (Contd.)**

Question		Marking details	Marks Available
6.	(a)	Wasted energy = $1000 - 876 - 100 = 24$ [J]	1
	(b)	Efficiency = $\frac{976}{1000} \times 100 = 97.6\%$ [976 (1) subs(1); ans (1)] Accept 98% [Award 2 marks only for answers of 10% / 87.6% / 97%] No <b>ecf</b> from (a)  <b>Question total</b>	3  <b>[4]</b>
7.	(a)	(i) wavelength = 4 [m] (1) (ii) amplitude = 50 [cm] (1)	2
	(b)	Frequency = $\frac{2.8}{4} = 0.7$ [Hz] [subs (1); ans (1)] <b>ecf</b> from (a)(i)  <b>Question total</b>	2  <b>[4]</b>
8.	(a)	0.5 [kW]	1
	(b)	(i) No. of kWh = $0.5 \text{ ecf} \times 5 \times 14 = 35$ [Subs (1); ans (1)]	2
		(ii) Cost = $35 \text{ ecf} \times 8 = 280$ [p] / £2.80	1
	(c)	(i) Less power / less energy / not as many Watts / less units of electricity	1
(ii) New cost = $\frac{1}{5} \times 280 \text{ ecf}$ [p] [or $0.1 \times 5 \times 14 \times 8$ ] = 56 [p](1) Saving = $280 - 56 \text{ ecf} = 224$ [p] [ans] (1)  <b>Question total</b>		2  <b>[7]</b>	
9.	(a)	(i) Plastic / glass containers allow microwaves to pass through them (2) <b>or</b> metal containers reflect microwaves / produce sparks / don't allow microwaves to pass through them (2)	2
		(ii) Microwave energy causes the <u>water</u> to be <u>heated</u> rapidly	1
	(b)	Any $2 \times (1)$ from <ul style="list-style-type: none"> <li>• different wavelength / frequency ✓</li> <li>• greater penetration ✓</li> <li>• ionises / damages cells of the body ✓</li> <li>• transfer more energy ✓</li> </ul> <b>Question total</b>	2  <b>[5]</b>

**Physics 1 (Legacy) Foundation Tier (Contd.)**

Question			Marking details	Marks Available
10.	(a)	(i)	8 [hours]	1
		(ii)	10 [GW]	1
	(b)	A period of low demand from users	1	
	(c)	Source of energy [falling water] at the flick of a switch or no time needed for the source to warm up	1	
	(d)	Reduces base load / produces less power by closing down for maintenance or reducing output further	1	
			<b>Question total</b>	<b>[5]</b>
11.	(a)		Gravitational attraction / gravity	1
	(b)		Both produced by fusion / hydrogen to helium or heavier elements / atoms forced together (1) with a release of [a large amount] of energy / heat <u>and</u> light (1)	2
	(c)		Balanced forces (1)	2
			Named forces (1)	
			<b>Question total</b>	<b>[5]</b>
			<b>Total Foundation paper</b>	<b>50</b>

**PHYSICS 1 (LEGACY)**

**HIGHER TIER**

<b>Question</b>			<b>Marking details</b>	<b>Marks Available</b>
1.	(a)	(i)	Plastic / glass containers allow microwaves to pass through them (2) <b>or</b> metal containers reflect microwaves / produce sparks / don't allow microwaves to pass through them (2)	2
		(ii)	Microwave energy causes the <u>water</u> to be <u>heated</u> rapidly	1
	(b)		Any 2 × (1) from <ul style="list-style-type: none"> <li>• different wavelength / frequency ✓</li> <li>• greater penetration ✓</li> <li>• ionises / damages cells of the body ✓</li> <li>• transfer more energy</li> </ul>	2
			<b>Question total</b>	<b>[5]</b>
2.	(a)	(i)	8 [hours]	1
		(ii)	10 [GW]	1
	(b)		A period of low demand from users	1
	(c)		Source of energy [falling water] at the flick of a switch or no time needed for the source to warm up	1
	(d)		Reduces base load / produces less power by closing down for maintenance or reducing output further	1
			<b>Question total</b>	<b>[5]</b>
3.	(a)		Gravitational attraction / gravity	1
	(b)		Both produced by fusion / hydrogen to helium or heavier elements / atoms forced together (1) with a release of [a large amount] of energy / heat <u>and</u> light (1)	2
	(c)		Balanced forces (1) Named forces (1)	2
	(d)	(i)	19 <sup>th</sup> century model used the idea of chemical reaction / energy (burning) [produce the heat and light generated by the star] (1). A short finite life of a few thousand years was predicted (1)	2
		(ii)	Geologists discovered that the Earth was millions of years old.	1
			<b>Question total</b>	<b>[8]</b>



**Physics 1 (Legacy) Higher Tier (Contd.)**

Question			Marking details	Marks Available
6.	(a)	(i)	Reduces convection [losses] / traps radiation	1
		(ii)	Black surfaces are <u>better / good absorbers of radiation / infra-red</u> so temperature increases.	1
	(b)	(i)	Maximum power = 2.4 [kW] (1) Minimum power = 0.96 [kW] (1) Award 1 mark for 2400 & 960 Award 1 mark for 4.8 & 1.92	2
		(ii)	Average of maximum and minimum powers shown <b>ecf</b> (1) 1.68 <b>ecf</b> x 10 = 16.8 [kWh] (1)	2
	(c)	Any 2 x (1) from: <ul style="list-style-type: none"> <li>• Average power of sunlight greatly reduced in winter</li> <li>• Sunlight is available for less day time</li> <li>• Energy delivered much less</li> <li>• Outside temperature is colder</li> <li>• Water starts off colder so requires more heat to be supplied to it</li> </ul>	2	
<b>Question total</b>			<b>[8]</b>	
7.	(a)		Wave speed decreases as the frequency increases (1); non-linearly / inversely proportional (1)	2
		(b)	$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{311000}{12 \times 60 \times 60} = 7.20 \text{ [m/s]}$ Subs (1); conversion (1); ans (1) From graph speed = 7.20, frequency = 0.22 [Hz] (1) $v = f\lambda, 7.22 = 0.22 \text{ ecf } \lambda$ $\lambda = \frac{7.22}{0.22} = 32.73 \text{ [m]}$ Subs (1); manipulation (1); ans (1) No penalty for incorrect rounding throughout.	7
<b>Question total</b>			<b>[9]</b>	
<b>Total Higher Tier</b>			<b>50</b>	

**PHYSICS 2 - FOUNDATION TIER**

Question			Marking details	Marks Available
1.	(a)	(i) gamma (1) [accept: $\gamma$ , gama] (ii) gamma (1) [accept: $\gamma$ , gama] (iii) alpha (1) [accept: $\alpha$ , alfa, alffa]		3
	(b)	Any 2 $\times$ (1) from: reduce exposure time ( $\checkmark$ ), <u>protective clothing</u> ( $\checkmark$ ), barrier ( $\checkmark$ ), breathing apparatus ( $\checkmark$ ), handling equipment (1), monitoring equipment ( $\checkmark$ ) [One mark available for each line – if one line is blank, 2 marks are available for the other line] <b>Question total</b>		2  <b>[5]</b>
2.	(a)	(i) 10% (ii) cosmic [accept: rays from the sun] (iii) nuclear power stations only contribute a very small part, or equiv [must recognise the low level contribution] – accept the converse argument. (iv) 30 [cpm]		1 1 1 1
	(b)	radon gas levels vary / difference in rock <u>type</u> / altitude [Not just: proximity to radiation source] <b>Notes:</b> Context must be correct if given, e.g. Limestone is more radioactive $\times$ Granite / igneous rocks more radioactive $\checkmark$ It depends if there are radioactive substances in the area – $\times$ not specific enough. <b>Question total</b>		1  <b>[5]</b>
3.	(a)	<b>Lamp</b>		1
	(b)	$\frac{920}{230}$ (1) = 4 [A] (1) [correct answer $\rightarrow$ 2 marks]		2
	(c)	13, 3, 13 in last three cells <b>Question total</b>		1  <b>[4]</b>

**Physics 2 (Legacy) Foundation Tier (Contd.)**

Question		Marking details	Marks Available	
4.	(a)	A and V in correct places [accept a and v]	1	
	(b)	$R = \frac{2}{4}$ (1 subst) = 0.5 [ $\Omega$ ] (1 ans)	2	
	(c)	(i)	variable resistor [accept: rheostat / reostat]	1
		(ii)	variable resistor (ecf on name) altered in steps [Accept: change the resistance / the resistance changes the current]	1
	(d)	(i)	2 [V] [accept 2 – 2.1]	1
		(ii)	line curves beyond that point / it is straight only up to 2 V [accept a resistance calculation up to 2 V and at a higher voltage] <b>Notes:</b> The description of the change must be clear, e.g. <b>not:</b> the current starts to slow down $\times$ <b>not</b> increase in current slows down $\times$ <b>but</b> the current increases at a slower rate - $\surd$ b.o.d.	1
		<b>Question total</b>	<b>[7]</b>	
5.	(a)	$a = \frac{12}{4}$ (1 subs) = 3 (1 ans) Unit: m/s <sup>2</sup> (1)	3	
	(b)	$F = 90 \times 3$ <b>ecf</b> (1 subs) = 270[N] (1)	2	
			<b>Question total</b>	<b>[5]</b>

**Physics 2 (Legacy) Foundation Tier (Contd.)**

Question		Marking details	Marks Available
6.	(a)	$W = 500\,000 \times 0.9$ (1) = 450 000 [J] (1)	2
	(b)	Any 2 × (1) from <ul style="list-style-type: none"> <li>• crumple zone ✓ [not crumple zone!]</li> <li>• air bag ✓</li> <li>• rigid [accept strong] passenger cell ✓</li> </ul>	2
		<b>Question total</b>	<b>[4]</b>
7.	(a)	(i) stays the same [accept: <u>is</u> constant](1) increases [accept: <u>gets</u> bigger] (1)	3
		(ii) equal to (1)	
	(b)	decelerates (1) to a [new] constant speed (1)	2
		<b>Question total</b>	<b>[5]</b>
8.	(a)	all points plotted ± half square (2x1) deduct 1 mark for each wrong plot [min 0], smooth curve [ignore $t > 20$ hrs] (1)	3
	(b)	$7 \pm 0.5$ [h] [for incorrect graphs, take the graph reading ± 0.5 h]	1
		<b>Question total</b>	<b>[4]</b>
9.	(a)	takes current [accept: electricity] to ground / earth [Accept: prevents metal casings becoming live / stops the current going through the user / stops them getting electrocuted / an electric shock] <b>Notes:</b> The explanation must not have an incorrect context, e.g. <b>not</b> if there is too much current × <b>not</b> prevents fire ×	1
	(b)	Context mark: difference in live and neutral currents (1) Effect mark: makes it turn off [all] household circuits [accept: appliance] / operates a <u>magnetic</u> switch (1) ‘Stops the current’ – accept for the 2 <sup>nd</sup> mark. <b>Notes:</b> Effect mark can only be given if the context mark is given.	2
	(c)	Quick[er] acting [however expressed](1) [accept ‘straight away’] more sensitive [however expressed] (1)	2
		<b>Question total</b>	<b>[5]</b>

**Physics 2 (Legacy) Foundation Tier (Contd.)**

Question		Marking details	Marks Available
10.	(a)	$t = \frac{9(1)}{15}$ [1 for 9 taken from graph] = 0.6 [s](1)	2
	(b) (i)	42(1) – 12(1) = [30 m] [correct answer, only, implies correct working] <b>Notes:</b> Credit 42 (✓) and 12 (✓) and 30 (✓✓) in the working space, but if 30 is further manipulated to give a final incorrect answer, 1 mark is given. Do not credit 42 or 12 in the answer line – × If correct distances are <u>added</u> – 1 mark only.	2
	(ii)	because the total stopping distance increases as a curve / because the graphs are not straight. <b>Notes:</b> If numerical answer for 10 m/s given [braking distance 7.5 m] credit only if a suitable comment is given, e.g. ‘this is not / less than half the 20 m/s value’	1
	(c)	[The driver is] tired / drunk / drugged / distracted (e.g. phone / inattentive) / old aged [accept just: alcohol]	1
<b>Question total</b>			<b>[6]</b>
<b>Total For Foundation Tier paper</b>			<b>50</b>

**PHYSICS 2 (LEGACY)**

**HIGHER TIER**

<b>Question</b>		<b>Marking details</b>	<b>Marks Available</b>
1.	(a)	all points plotted $\pm$ half square (2x1) deduct 1 mark for each wrong plot [min 0], smooth curve [ignore $t > 20$ hrs] (1)	3
	(b)	$7 \pm 0.5$ [h] [for incorrect graphs, take the graph reading $\pm 0.5$ h]	1
	(c)	yes because: [it is a gamma emitter] – so it escapes the body / can be detected outside [accept: low ionizing / highly penetrating] (1), suitably short half life (1)	2
	<b>Question total</b>		<b>[6]</b>
2.	(a)	takes current [accept: electricity] to ground / earth [Accept: prevents metal casings becoming live / stops the current going through the user / stops them getting electrocuted / an electric shock] <b>Notes:</b> The explanation must not have an incorrect context, e.g. <b>not</b> If there is too much current $\times$ <b>not</b> prevents fire $\times$	1
	(b)	Context mark: difference in live and neutral currents (1) Effect mark: makes it turn off [all] household circuits [accept: appliance] / operates a <u>magnetic</u> switch (1) ‘Stops the current’ – accept for the 2 <sup>nd</sup> mark. <b>Notes:</b> Effect mark can only be given if the context mark is given.	2
	(c)	Quicker acting [however expressed](1) [accept ‘straight away’] more sensitive [however expressed] (1)	2
	<b>Question total</b>		<b>[5]</b>

**Physics 2 (Legacy) Higher Tier (Contd.)**

Question		Marking details	Marks Available	
3.	(a)	$t = \frac{9(1)}{15} [1 \text{ mark for '9' taken from graph}] = 0.6 [s](1)$ <p><b>Notes:</b> '9' in the answer space does not score</p>	2	
	(b)	(i)	<p>42(1) – 12(1) = 30 [m] [correct answer, only, implies correct working]</p> <p><b>Notes:</b> Credit 42 (✓) and 12 (✓) and 30 (✓✓) in the working space, but if 30 is further manipulated to give a final incorrect answer, 1 mark is given.</p> <p>Do not credit 42 or 12 in the answer line – ✗</p> <p>If correct distances are <u>added</u> – 1 mark only.</p>	2
		(ii)	<p>because the total stopping distance increases as a curve / because the graphs are not straight.</p> <p><b>Notes:</b> If numerical answer for 10 m/s given [braking distance 7.5 m] credit only if a suitable comment is given, e.g. 'this is not / less than half the 20 m/s value'</p>	1
	(c)	<p>[The driver is] tired / drunk / drugged / distracted (e.g. phone / inattentive) / old aged [accept just: alcohol]</p>	1	
		<b>Question total</b>	<b>[6]</b>	
4.	(a)	(i)	gamma [nuclear radiation – not enough]	1
		(ii)	Repeat the experiment / carry out similar experiments	1
		(iii)	Publish his results / allow others to verify / share outcomes [however expressed, e.g. patent the experiment]	1
	(b)	(i)	<p>When inhaled (1)</p> <p>radon emits alpha particles [inside the body] (1)</p> <p>which cannot escape [the body] [<b>not just</b> 'cannot get through the skin']/ are [highly] ionising / damage DNA / damage cells [<b>not destroy cells</b>] (1) [<b>not just:</b> 'causes cancer].</p> <p><b>Notes:</b> It must be clear that <u>radon</u> enters the body and <u>alpha</u> [particles] cause the ionisation</p>	3
(ii)		Seal floors / increase ventilation. Not 'insulation' - ✗	1	
(iii)		<p>Any 2 × (1) from:</p> <p>reduce exposure time (✓), <u>protective</u> clothing (✓), barrier (✓), breathing apparatus (✓), handling equipment (1), monitoring equipment (✓)</p>	2	
		<b>Question total</b>	<b>[9]</b>	

Physics 2 (Legacy) Higher Tier (Contd.)

Question		Marking details	Marks Available	
5.	(a)	<ul style="list-style-type: none"> <li>initially the weight is greater than the air resistance / the resultant force is downwards (1) [accept: the force of gravity / weight produces a downward acceleration]</li> <li>air resistance [or upward force] increases / resultant force decreases (1)</li> <li>[eventually] air resistance [or upward force] equals weight [or downward force] / zero resultant force (1)</li> </ul> <p><b>Notes:</b> Unless the terms air resistance [or drag or equiv] <b>and</b> weight [or gravitational force – accept gravity] are correctly used at least once, a maximum of 2 marks can be awarded.</p>	3	
	(b)	<p>correct initial curvature (1) levelling off [NB must not be higher than the parachute opening point – but allow some tolerance] (1)</p> <p><b>Question total</b></p>	2 <b>[5]</b>	
6.	(a)	(i)	<p>Current = <math>\frac{2000(1)}{230} = 8.70</math> [A ](1)</p> <p><b>Notes:</b> <math>\frac{2}{230} \rightarrow 0.0087 \rightarrow 1</math> mark</p> <p><math>\frac{2}{230} \rightarrow 8.7 \rightarrow 1</math> mark</p> <p><math>\frac{2 \text{ kW}}{230 \text{ V}} \rightarrow 8.7 \rightarrow 2</math> marks</p> <p><math>\frac{2}{230} \rightarrow 115 \rightarrow 0</math> marks</p>	2
		(ii)	<p>110 = <math>I \times 26.45</math> (1 sub)</p> <p>Current = <math>\frac{110}{26.45}</math> (1 manip) = 4.16 [A] (1)</p> <p>(Accept 4.2 but not 4.1 or 4)</p>	3
		(iii)	<p>Longer time to boil / converse</p>	1 1
	(b)	(iv)	<p>Would burn out [accept: break] / blow a fuse/overheat <b>Not</b> – kettle / fuse will blow <u>up</u></p> <p>Any 3 × (1) from: Advantage: safer (✓), because less likely to <u>be killed</u> by 110 than 230 V / smaller [current] shock (✓) Disadvantage: thicker wires have to be used for the same power appliances (✓) because the current taken is bigger (✓)</p> <p><b>Question total</b></p>	3 <b>[10]</b>

Physics 2 (Legacy) Higher Tier (Contd.)

Question		Marking details	Marks Available
7.	(a)	$\text{accel} = \frac{1.6 \times 10^6}{1.2 \times 10^8} = (1 \text{ subst or manip}) = 0.01[3333] \text{ [m/s}^2\text{]} (1 \text{ ans})$	2
	(b) (i)	Work $= 2400 \times 1.6 \times 10^6 (1)$ $= 3.84 \times 10^9 \text{ [J]} (1)$	2
	(ii)	Initial K.E. $= 0.5 \times (1.2 \times 10^8) \times 5^2$ $= 1.5 \times 10^9 \text{ J} (1)$  Final K.E. $= 0.5 \times (1.2 \times 10^8) \times 9^2$ $= 4.86 \times 10^9 \text{ J} (1)$  K.E. increase $= 3.36 \times 10^9 \text{ [J]} \text{ [correct answer} \rightarrow 2 \text{ marks]}$	2
	(iii)	W.D against drag $= 3.84 \times 10^9 - 3.36 \times 10^9$ $= 4.8 \times 10^8 \text{ [J]} (1) \text{ e.c.f. from (b)(i) and (ii)}$  Force $= \frac{\text{WD}}{d} = \frac{4.8 \times 10^8 \text{ (ecf)}}{2400} (1 - \text{subs}) + (1 - \text{manip})$ $= 2 \times 10^5 \text{ [N]}$	3
		<b>Question total</b>	<b>[9]</b>
		<b>Total Higher Tier</b>	<b>50</b>

**PHYSICS 3 (LEGACY)**

**FOUNDATION TIER**

Question		Marking details	Marks Available
1.		(i) Neutron (1) and electron (1) correctly labelled	2
		(ii) Thomson: solid (1), positive charge spread throughout atom (1), negative charges dotted throughout atom (1) no protons (1), no neutrons (1), no electron shells / orbits (1), no nucleus (1) OR alternative statements about nuclear atom e.g. mass concentrated in centre (1), mainly made up of empty space (1) Assume reference to “it” is referring to the Thomson model.	3
		<b>Question total</b>	<b>[5]</b>
2.		(i) 20 000 underlined (1)	3
		(ii) reflection (1) (iii) longitudinal (1)	
		<b>Question total</b>	<b>[3]</b>
3.	(a)	(i) Gradient = $\frac{25}{50}$ (1), 0.5 [m/s <sup>2</sup> ] (1)	2
		(ii) Area = 25 x 150 (1), = 3750 [m] (1)	2
	(b)	Time of 300 s from graph (1),	2
		Subs $\frac{5625}{300} = 18.75$ [m/s] (1) (accept 18.75 – 19)	
	(c)	Correct description (momentum increases, becomes constant, and then decreases) (1) Constant momentum value calculated: 30 000 x 25 = 750 000 [kg m/s] (1), One correct reference to 0 i.e. either momentum increases from 0 <b>or</b> momentum decreases to 0. (1)	3
		<b>Question total</b>	<b>[9]</b>

**Physics 3 (Legacy) Foundation Tier (Contd.)**

Question		Marking details	Marks Available
4.	(i)	In order downwards: C-D-B-A (3 all correct; 2 if 2/3 correct; 1 if 1 correct)	3
	(ii)	B & C or ${}^4_2\text{He}$ & ${}^3_2\text{He}$	1
		<b>Question total</b>	<b>[4]</b>
5.	(i)	P waves travel faster than S OR they travel at different speeds	1
	(ii)	P longitudinal S transverse(1) P travel through liquids / S don't (1)	2
	(iii)	P waves travel faster than S (only award if <b>not</b> referred to in (i)) Signal will <u>only</u> have P waves, (1) since S waves can't pass through [liquid] core (1)	2
		<b>Question total</b>	<b>[5]</b>

**Physics 3 (Legacy) Foundation Tier (Contd.)**

Question			Marking details	Marks Available											
6.	(a)	(i)	Few radioactive particles produced / doesn't give off radiation (1) greater energy released than fission / 710 units of energy released compared to 223 units (1)	2											
		(ii)	Award any 2 marks out of 3: To bring protons / nuclei / atoms close enough together, (1) nuclear forces overcome repulsion (1) high temperature needed (1)	2											
		(iii)	[Large] atom splits [into 2 smaller atoms]	1											
	(b)	(i)	To slow the <u>neutrons</u> down,(1) so they are absorbed by the uranium atoms / so fission can occur (1)	2											
		(ii)	Control / boron rods, (1) absorb [some] <u>neutrons</u> (1)	2											
<b>Question total</b>			<b>[9]</b>												
7.	(a)	(i)	Flicks to left [and returns to middle / zero] (1)	2											
		(ii)	Flicks to left [and returns to middle / zero] (1)												
	(b)	1 mark for each correct row		3											
		<table border="1"> <thead> <tr> <th>Change to generator</th> <th>Effect on voltage</th> <th>Effect on frequency</th> </tr> </thead> <tbody> <tr> <td>More turns on the coil</td> <td>increase</td> <td>stays the same</td> </tr> <tr> <td>Spinning the coil slower</td> <td>decrease</td> <td>decrease</td> </tr> <tr> <td>Using stronger magnets</td> <td>increase</td> <td>stays the same</td> </tr> </tbody> </table>			Change to generator	Effect on voltage	Effect on frequency	More turns on the coil	increase	stays the same	Spinning the coil slower	decrease	decrease	Using stronger magnets	increase
Change to generator	Effect on voltage	Effect on frequency													
More turns on the coil	increase	stays the same													
Spinning the coil slower	decrease	decrease													
Using stronger magnets	increase	stays the same													
<b>Question total</b>			<b>[5]</b>												

**Physics 3 (Legacy) Foundation Tier (Contd.)**

Question		Marking details	Marks Available
8.	(a)	In a transverse wave, the <i>vibrations (1)</i> are <i>at right angles</i> to the <i>direction of motion (1)</i> . In a longitudinal wave, <i>the vibrations (1)</i> are <i>parallel to the direction of travel (1)</i> . (Maximum of 2 marks per statement) Only award a mark for vibrations once and it must be used in the correct context. Award a maximum of 3 marks in total.	3
	(b)	Correct angle of reflected ray (by eye) (1), wavefronts shown parallel and same wavelength drawn on reflected ray (by eye)(1)  <b>Question total</b>	2  <b>[5]</b>
9.	(a)	(i) More turns on output coil / larger voltage on output coil	1
		(ii) Concentrates field [through coils] / makes the magnetic field stronger	1
	(b)	(i) B	1
		(ii) D,(1) output voltage less than input / decreases the voltage (1)	2
<b>Question total</b>		<b>[5]</b>	
<b>Total For Foundation Tier paper</b>			<b>50</b>

**PHYSICS 3 (LEGACY)**

**HIGHER TIER**

Question			Marking details	Marks Available									
1.	(a)	(i)	Reference to a magnetic field around the magnet (1) when magnet moves or the <u>magnetic field</u> changes / is cut [by the turns in the coil] (1) this induces / produces / creates a current/voltage (1)	3									
		(ii)	Flicks to left [and returns to middle / zero] (1) Flicks to left [and returns to middle / zero] (1)	2									
	(b)	1 mark for each correct row		3									
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Change to generator	Effect on voltage	Effect on frequency											
More turns on the coil	increase	stays the same											
Spinning the coil slower	decrease	decrease											
Using stronger magnets	increase	stays the same											
<b>Question total</b>				<b>[8]</b>									
2.	(a)	In a transverse wave, the <i>vibrations (1)</i> are <i>at right angles</i> to the <i>direction of motion (1)</i> . In a longitudinal wave, <i>the vibrations (1)</i> are <i>parallel to the direction of travel (1)</i> . (Maximum of 2 marks per statement) Only award a mark for vibrations once and it must be used in the correct context. Award a maximum of 3 marks in total.		3									
	(b)	Correct angle of reflected ray (by eye) (1), wavefronts shown parallel and same wavelength drawn on reflected ray (by eye)(1)		2									
<b>Question total</b>				<b>[5]</b>									
3.	(a)	(i)	More turns on output coil / larger voltage on output coil	1									
		(ii)	Concentrates field [through coils] / makes the magnetic field stronger	1									
	(b)	(i)	B	1									
	(ii)	D, (1) output voltage less than input / decreases the voltage (1)	2										
	(iii)	Correct form of equation (1), appropriate pair of voltages from graph e.g. 3 & 12 (1) Subs (1), answer 200 (1)	4										
<b>Question total</b>				<b>[9]</b>									
4.	(a)	(i)	Subs into gradient – time 20 and speed 20 (1), answer = 1 [m/s <sup>2</sup> ] (1)	2									
		(ii)	Attempting a calculation of area (1), 3900 [m] (1)	2									
	(b)	Addition of areas–3900 (ecf) + 3500 = 7400 (1), division by 400 (1), 18.5 [m/s] (1)		3									
<b>Question total</b>				<b>[7]</b>									

**Physics 3 (Legacy) Higher Tier (Contd.)**

Question			Marking details	Marks Available	
5.	(a)	(i)	[High] <u>frequency</u> sound <u>above 20 000 Hz</u> /too high a <u>frequency to be heard</u>	1	
		(ii)	Award any 2 marks out of 3: Reflected / echo (1) when they hit a boundary between different media / densities / layers / parts of the baby (1) time taken for the reflections is used to create an image (1)	2	
	(b)		Conversion of 6 MHz to 6 000 000 Hz, (1) manipulation, (1) answer = 0.00025 [m] (1) (Answer of 250 [m] = 2 marks)	3	
			<b>Question total</b>	<b>[6]</b>	
6.	(a)	(i)	[Total] momentum before [a collision] = [total] momentum after [collision] [provided no external forces act] <b>Don't</b> accept momentum stays the same or momentum is conserved	1	
		(ii)	Calculation of initial momentum: 5 x 1200 = 6000 (1) [recognition that final momentum must also be 6000] momentum of Car A = 6000 -2400=3600 (1) velocity of car A = 6 [m/s] (1)	3	
		(iii)	Change in momentum = 3600, divided by 0.2 = 18 000 [N]	1	
		(iv)	Collision time / distance would increase,(1) therefore force decreases(1)	2	
	(b)		Correct calculation of KE shown for either: 15 000 or 2400 (1) Correct answer = 12 600 [J] (1) OR 0.5 x 1200 (25-4) = 12 600 [J] (2 marks)	2	
			<b>Question total</b>	<b>[9]</b>	
7.	(a)		Requires very high temperature / pressure / lots of heat (1) For 2 <sup>nd</sup> mark either: Because need to overcome the repulsion between [positive] <u>nuclei</u> / <u>protons</u> or difficult to contain.	2	
		(b)	(i)	${}^2_1\text{H} + {}^3_1\text{H} = {}^4_2\text{He} + {}^1_0\text{n}$ (1 mark each for left and right hand side of equation) (Accept D and T or De and Tr) Correct word equation with numbers = 1 mark	2
			(ii)	3 protons in Li nucleus compared to 1 in H (1) 3 neutrons in Li nucleus compared to 2 in H (1) Correct comparison with no numbers included maximum of 1 mark Reference to electrons no marks	2
			<b>Question total</b>	<b>[6]</b>	
			<b>Total Higher Tier</b>	<b>50</b>	



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