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GCE Ordinary Level

Mark Scheme with Examiners' Report

London Examinations Ordinary Level GCE in Physics (7540)

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PHYSICS 7540, MARK SCHEME

Abbreviations used in the mark scheme

UP	unit penalty
TE	transmits the error
OWTTE	or words to that effect
SF	Significant figures
SFP	Significant figure penalty
MAX	Maximum

PAPER 1

1.	(a)	use of gradient or v – u / t	**(1)**
		acceleration = 1.2 m/s^2 **UP** accept values from 1.1 to 1.3	**(1)**
	(b)	F = (ma =) 0.80 x 1.2 **TE**	**(1)**
		= 0.96 N **UP**	**(1)**
	(c)	straight line from 0,0 below first line	**(1)**
		from 0,0 heading for 1.0,0.6 reaching at least t = 0.6 s	**(1)**
		(allow 1 square in vertical direction)	
		dependent on 1st mark	
			Total 6 marks
2.	(a)	radiated from flame (to saucepan or aluminium)	
		conducted through the aluminium/metal	
		convected through the water (Any two)	
		allow correct description of each process	
		Maximum	**(2)**
	(b)	plastic is a poor/ non conductor or (good) insulator	**(1)**
		does not get hot / stays cool / does not burn hand	**(1)**
		(accept reverse argument) independent marks	
	(c)	<u>air</u> (above water) is heated	**(1)**
		(hot fluids) expand or less dense	**(1)**
		warm / hot fluids rise	**(1)**
		2nd and 3rd marks may be awarded for convection in water but ignore references to radiation and evaporation	
			Total 7 marks
3.	(a)	Pressure = 0.85 x 1000 x 10	**(1)**
		= 8500 Pa or N/m^2 **UP**	**(1)**
	(b)	Force = 8500 x 1.2 x 10^{-3} TE	**(1)**
		= 10.2 N	**(1)**
	(c)	10.2 x *y* = 5 x 0.2 TE	**(1)**
		y = 0.098 m	**(1)**
	(d)	Smaller mass / weight or mass closer to pivot or pad further from pivot or move pivot to right / increase y	**(1)**
			Total 7 marks

4.			mass	**(1)**
			velocity (not speed)	**(1)**
			kg m/s or Ns	**(1)**
			zero / nought	**(1)**
			equal / same size / same magnitude	**(1)**
			opposite / negative / reversed direction	**(1)**
			first two and last two marks can appear in either order	
				Total 6 marks
5.	(a)	(i)	molecules too small (to see) / very small	**(1)**
			'microscope not powerful enough' scores zero	
		(ii)	1×10^{-9} to 1×10^{-10} m **UP**	**(1)**
			can be scored in (a)(i)	
	(b)	(i)	light from smoke/ash/soot (particles) ignore 'oil'	**(1)**
			(not smoke molecules)	
		Ω		
		(ii)	(moving) air (molecules or particles)	**(1)**
			collision between smoke and air	**(1)**
			unevenly / unequally (hit)	**(1)**
			2nd and 3rd marks dependent on 1st mark	
				Total 6 marks
6.	(a)		there are like / similar positive / negative charges facing each other / near each other / close together	**(1)**
			like charges repel	**(1)**
			'random molecular motion of molecules in liquid' scores 1 out of 2	
	(b)		no free charges / electrons / ions	**(1)**
			no flow/ movement / carry of charge/ electrons/ ions	**(1)**
	(c)		0.025 x 240 or 0.025 x 4	**(1)**
			= 6 C or As UP correct answer only	**(1)**
				Total 6 marks
7.	(a)		$V_1 = 2 \times 4$	**(1)**
			= 8 V **UP only once for V in (a) and (c)**	**(1)**
	(b)		2 A **UP**	**(1)**
	(c)		12 – 8 or R = 12 / 2 = 6 Ω, 6 – 4 = 2 Ω, $V_2 = 2 \times 2$	**(1)**
			= 4 V **TE** 12 – (a) **UP**	**(1)**
	(d)		4 / 2 = 2 Ω or (12 / 2) – 4 = 2 Ω UP	**(1)**
			TE (c) / 2	
	(e)		12 x 2	**(1)**
			X time (60 or 1)	**(1)**
			= 1440 J **UP correct answer with unit only**	**(1)**
				Total 9 marks

8. (a) into paper, upward along axis of artery **(1)**

(b) no moving parts
no rotating coils
less wear and tear / damage (to blood or pump)
won't get stuck **(1)**
or relevant disadvantages (Any 1)

Not
more efficient, cheaper, lighter, automatic, safer, smoother flow of blood, no need to cut open patient or have operation

(c) hard **(1)**

retain magnetism / form permanent magnets / soft materials lose magnetism / need continuous magnetic effect **(1)**

do not have to be replaced regularly / can be used for a long time / continuous flow of blood is provided **(1)**
2nd and 3rd marks dependent on 1st

'*hard' and 'soft' mixed up scores 2 out of 3 e.g. 'soft because it retains its magnetism and doesn't have to be replaced'*

Total 5 marks

9. (a) Same number of protons / atomic number (different number of neutrons) ignore 'element' **(1)**

three **(1)**

(b) correctly circled **(1)**

(38 is mass number) / 38 –18 =20 / proton + neutrons = mass number **(1)**

(c) K / potassium / 19 **(1)**

(d) long half life **(1)**

activity would not be reduced too quickly **(1)**
could be used for many years
last a long time
steady / continuous count rate

Total 7 marks

10	(a)	2 Hz or /s UP	**(1)**
	(b)	6000 / 2 TE 6000 / (a) = 3000 m UP for m or km once only	**(1)** **(1)**
	(c)	distance = 6400 x 3.14 = 20096 km	**(1)**
		time = 20096000 / 6000 **TE** = 3349 s **UP**	**(1)** **(1)**
	(d)	other media encountered e.g. water amplitude reduced energy lost dies out / fades away **not** presence of mountains / slows down / gets reflected or refracted / it's a long way	**(1)**
		Total 7 marks	
11	(a)	correct ray to the screen any ray from the object that is refracted through the lens and destined for a point on the axis behind the screen **allowed** horizontal ray along axis / a legitimate ray above the axis not touching or cutting the existing ray **not allowed** ray cutting the axis before the screen or at the screen / horizontal ray in air (except along axis) / ray below axis in air pointing downwards (i.e. will not cut axis)	**(1)**
	(b)	Correct statements : first, third and fourth -1 for 4 ticks -2 for 5 ticks	**(3)**
		Total 4 marks	

Total for paper: 70 marks

PAPER 2

1. (a) (i) dots (roughly) evenly spaced/constant/equal/fixed spaces
steady/ uniform/ constant speed **(1)**
no unbalanced/net/resultant forces or force down ramp equals friction **(1)**
(not no external forces)
(Independent marks) **(1)**

(ii) measures distance between gaps **(1)**
>4 gaps (ie > 44 mm) **(1)**
time = correct number of gaps x 1/50 (see table below) **(1)**

speed = 11/(10/50) or <u>candidates</u> distance/<u>candidates</u> **(1)**
time= 55 cm/s or .55 m/s or 550 mm/s **UP** **(1)**

11	23	33	44								(mark 1)
				55	66	77	88	99	110	121	(marks 1 & 2)
.02	.04	.06	.08	.10	.12	.14	.16	.18	.20	.22	(mark 3)

(iii) <u>state</u> that gaps get bigger and bigger or acceleration occurs **(1)**
drawing of tape showing gaps increasing in size from left to right (unless labelled start and finish) **(1)** **(1)**
first gap ≥ than gaps in original diagram (10 mm or more)

11 marks

(b) (i) Newtonmeter/elastic cords 1F, 2F and 3F/mass on string over edge of bench **(1)**
method of fixing cords etc to trolley / ruler/pulley/ (top pan) balance (to measure mass) **(1)**

(ii) (**Maximum six** from the following – 1 mark each):
1. attach newtonmeter/elastic/mass +string to trolley **(1)**
2. switch on ticker timer/attach ticker tape **(1)**
3. pull trolley using a <u>constant force/extension</u> **(1)**
4. calculate/find/measure <u>acceleration</u> (from tape) **(1)**
5. repeat for <u>other</u> force(s) **(1)**
6. plot a graph of acceleration versus force **(1)**
7. straight line graph through 0,0 / statement force proportional to acceleration **(1)** **(max 6)**

(iii) repeat readings for <u>each</u> force **(1)**
(independent of (ii))
(award mark 3. here if not given in (ii) instead of repeat)

9 marks
Total 20 marks

2.	(a)	(i)	GPE = 65 x 10 x 565	**(1)**
			= 367 250 J or Nm **UP**	**(1)**
			(NB UP for Joules or Nm only once in (i) to (iii))	
		(ii)	KE = ½ x 65 x 68^2	**(1)**
			= 150 280 J **UP**	**(1)**
		(iii)	difference = 367 250 – 150, 280 = 216 970J	**(1)**
			(TE candidates answers for positive values only)	
		(iv)	Converted to heat/internal energy (ignore sound)	**(1)**
			In the surroundings/skis/air/atmosphere	**(1)**
			(second mark dependent on first)	
				7 marks
	(b)	(i)	216 970 **(TE)** = Force x 1740	**(1)**
			force = 216 970 / 1740	**(1)**
			force = 124.7N **UP**	**(1)**
			(calculation of a then use of f=ma scores 0/3)	
		(ii)	(friction) with ground /slope/surface/Earth snow	**(1)**
			(accept drag force with ground etc)	**(1)**
			air (friction)/resistance/ wind resistance	
		(iii)	force(s) or speed vary during run	**(1)**
				6 marks
	(c)	(i)	weight = 650N (stated) **UP**	**(1)**
			pressure = 650/0.57 **TE**	**(1)**
			= 1140 Pa or N/m^2 **UP** no penalty for sig figs	**(1)**
		(ii)	1. speed slower	**(1)**
			2. smaller area	**(1)**
			3. greater pressure	**(1)**
			4. more friction	**(1)**
			Or:	
			1. same speed	**(1)**
			2. same downward force	**(1)**
			3. same friction (with ground)	**(1)**
			4. any reference to air friction being the same	**(1)**
				7 marks
			(In each case marks 2 to 4 must relate to mark 1 and are dependent on mark 1)	

Total 20 marks

3.	(a)	(i)	1. dispersion at face AB	**(1)**
			2. increased dispersion at face AC (not parallel) *(award even if zero dispersion at AB)*	**(1)**
			3. correct deviation at each face (for all rays)	**(1)**
			4. correct order of colours (on screen) (Red and violet/blue at edges sufficient)	**(1)**
			independent marks	
		(ii)	some outside red **TE** from (i) only if red is at an end if (a)(i)4 not awarded only allow IR at the top end.	**(1)**
		(iii)	thermometer/thermistor/ thermocouple/ thermopile/camera or film	**(1)**
			blackened/sensitive to infra red/detects IR	**(1)**
			reading increased/ resistance lower/ bright area next to red/some effects on film *relates to mark 1*	**(1)**
				8 marks
	(b)	(i)	scale and orientation 0.01 = 5 cm on y-axis BUT accept 0.01 = 4 cm	**(1)**
			axes labelled with units	**(1)**
			plots	**(2)**
			curve (not a series of straight lines joining dots)	**(1)**
		(ii)	in range 1.538 to 1.539 no unit or else **UP**	**(1)**
		(iii)	blue	**(1)**
			low wavelength end/ higher refractive index *dependent on first mark*	**(1)**
				8 marks
	(c)	(i)	sin 25 / sin r = <u>1.536</u>	**(1)**
			r = 15.9° - 16.0° **no UP**	**(1)**
		(ii)	(angle) greater than critical angle (at AC) or $>40.6^0$	**(1)**
			total internally <u>reflected</u> (at AC)	**(1)**
				4 marks

Total 20 marks

4.	(a)	(i)	T in range 0.0125 - 0.013	**(1)**
			1/T = 1 / 0.0125 or 2/0.025 **TE**	**(1)**
			= 80 Hz or c/s or hz or per sec or /s **UP** 76.9 Hz if T = 0.013 / 8 Hz if T = 0.125 / 83.3 Hz if T = 0.012	**(1)**
		(ii)	0.005	**(1)**
			x 4	**(1)**
			= 0.02mm **UP** zero displacement can score marks 1 & 2 *2nd mark dependent on first*	**(1)**
		(iii)	250 x 80 **TE or start from scratch** (250/T)	**(1)**
			= 20 000	**(1)**
				8 marks
	(b)	(i)	higher/greater pitch / sharper / more shrill/higher sound	**(1)**
		(ii)	Louder / more volume **not more sound**	**(1)**
		(iii)	materials collide too forcefully OWTTE — loss of contact	**(1)**
			OR	**(1)**
			breaks/damages paint or probe — between probe and paint	
			2nd mark dependent on 1st mark in either case	
				4 marks
	(c)	(i)	stop beta rays going directly to detector (not to hold the source in place)	**(1)**
		(ii)	**Alpha:** no	**(1)**
			absorbed by paint / won't reach detector / (might) not reach paint	**(1)**
			Gamma: no	**(1)**
			penetrate paint/material or not affected by different thicknesses of paint Yes in either case scores 0/2	**(1)**
		(iii)	deflected /path changed (in magnetic field)	**(1)**
			miss detector or reduce number reaching detector/paint/material *independent marks*	**(1)**
		(iv)	<u>background</u> radiation / count	**(1)**
				8 marks
				Total 20 marks

5. (a) **Circuits**

(i)
(ii)

A1
A2 **(4)**

A3

Open

Yes
No
(1)
No
(1)

Closed

Yes
Yes
(1)
Yes
(1)

(b) **Choice**	Q	**(1)**	
Reason	or else current is drawn / extender is on all the time / so current is drawn only when switch is closed NOT because it is a series circuit *2nd mark dependent on 1st*	**(1)**	**2C**
(c) (i) **Apparatus**	rule or <u>measuring</u> tape/scale	**(1)**	**1A**
(ii) **Procedure**	1. close switch	**(1)**	
	2. chime sounds	**(1)**	
	3. move chime further distance from extender	**(1)**	
	4. note (intensity / amplitude of) sound	**(1)**	
	5. repeat until chime not heard/stops working	**(1)**	
	6. measure distance (between extender and chime)	**(1)**	
	7. repeat (the whole experiment) or each reading as they go along	**(1)**	**Max 6P**
	A table of results could score marks 3 to 7 Keep bell ringing and move away from extender can score marks 1 to 5		
(iii) **Difficulty**	cannot hear chime at large distance from switch need second person / need microphone and CRO	**(1)** **(1)**	**2D**

(d) **Metal**

1. place extender and chime apart **(1)**
2. this distance to be less than maximum found in/check it sounds **(1)**
3. place metal (plate) between extender and chime **(1)**
4. close switch **(1)**
5. chime does not sound **(1)**

Maximum 4 marks

metal plate/ box/ piece **(1)**

5 marks

Total 20 marks

Paper Total 100 marks

PHYSICS 7540, CHIEF EXAMINER'S REPORT

PAPER 1

General Comments

Some very good work was seen on this paper. Many candidates confidently performed the calculations (apart from question 10(c)) but the descriptive parts in questions 2, 5(b)(ii), 6(a)(b) and 8(b)(c) often showed hesitancy and confusion.

Question 1

Most candidates were able to use the slope of the velocity-time graph given in (a) to find the acceleration of a trolley. Some misreading from the graph was masked by the acceptance of values in the range 1.1 – 1.3 m/s^2.

Almost all candidates were able to calculate the force exerted on the trolley in (b) using $F = ma$ although a significant minority panicked and used $F = mg$. Marks were rarely lost for unit penalties in (a) and (b). In(c) a second line had to be added to the graph to represent the motion of a trolley with double the mass acted on by the same force. Practically all candidates knew that the slope would be half of the given line but a significant few were not accurate enough with their line. Sloppy work where lines were not straight did not score either mark in (c).

Question 2

In (a), candidates were asked to name the appropriate means of heat transfer involved in heating a saucepan of water from a flame placed under the saucepan. Any two from 'radiation from the flame', 'conducted through the saucepan' and 'convected through the water' would have scored. Many correct answers were seen together with detailed descriptions of, particularly, convection. This scored a mark but it meant that the candidates sometimes ran out of space to score the second mark.

In (b), candidates were asked to explain why the saucepan handle was made from plastic rather than aluminium. Many knew that plastic was a poor conductor of heat but, for the second mark, repeated themselves by claiming that the plastic did not conduct heat rather than stating that the handle does not get hot.

A description of convection has been asked for regularly in past papers. Candidates do not always realise what is gaining heat (the air above the water surface in this case) and we are still seeing too many statements like 'hot water molecules are lighter or less dense than cold ones,' which gain no marks.

Question 3

This question was very well answered, considering the number of places where candidates could go wrong. In (a) the use of *height* x *density* x *g* was almost always correctly executed with the correct unit shown.

Similarly the use of $F = p \times A$ in (b). It was particularly pleasing to see the use of the weight of the 0.50 g mass in (c). A mercifully rare error was to see
1 / 10.2 incorrectly rounded to 0.09 m from 0.098 m. Part (d) included many sensible suggestions as to how the lever arrangement could be changed so that the water leaks when the level of water in the tank is lowered.

Question 4

Candidates were asked to fill in the gaps in a number of sentences defining linear momentum, giving its unit and describing the recoil of a gun when firing a bullet. This was very well answered by almost everyone, the exception being the fourth gap, 'When a bullet is fired from a stationary gun the total momentum of the gun and the bullet will be …………'. Candidates produced a range of responses other than the anticipated 'zero', including 'same' and 'equal'.

Question 5

In (a)(i) candidates were asked why water molecules could not be seen through a school microscope. Candidates often spoilt a good answer that started off with reference to their very small size by linking it to a shortcoming of the microscope. It seemed as if some candidates thought the molecules could be seen with a more powerful microscope. Candidates need to be very careful in their choice of words to avoid undoing good work.

In (a)(ii) many of those candidates who quoted a value for the typical size of a molecule were in the correct range. This is another question that is asked regularly but still many candidates leave the answer blank.

In (b)(i), candidates who did not know that the bright specks were smoke particles struggled to score marks in (b)(ii) for explaining why the specks move with random jerky motion.
The mark scheme for (b)(ii) was as follows:

air (particles or molecules)	1 mark
collide with smoke (particles)	1 mark
unevenly	1 mark

with the second and third marks dependent on the first.

Common errors arose where candidates were still describing water molecules or collisions with the side of the container.

The third mark was only scored by the strongest candidates. If smoke particles are to move in a jerky manner it must be because they are being hit unevenly. As a general rule, terms given in the stem of a question, like 'randomly', should be avoided when explaining such behaviour.

Question 6

In (a) most candidates offered the explanation that 'like charges repel' and 'unlike charges attract'. The former scored the second mark and the latter was ignored. The first mark required candidates to note that like charges were facing each other but most candidates ignored the position of the charges shown on the diagram. Some candidates noted that a reason for molecules not remaining in the positions shown was random molecular motion of the molecules in the liquid, and this merited one mark here.

In (b), a mark for reference to no free charges and hence no movement of charges was rarely scored. Instead there were numerous references to equal number of charges and neutral molecules.

In (c) the calculation often failed to feature seconds, but 0.025 x 4 scored one out of two for recall and use of a formula. The resulting answer of 0.1 C was treated as a unit penalty.

Question 7

This question was very well answered with many candidates scoring full marks. Part (b) was almost always correctly answered. Centres should note that transmitted error marks are scored throughout so it is in the best interests of the candidates to show all steps in their working, as recommended on the front of the examination paper.

In (a) a minority of candidates showed V_1 = 2 x 4 = 6V, scoring the first mark but not the second.

Then in (c), 12 – 6 = 6V scored the two marks for the potential difference across R_2.
In (e) a similar problem to that seen in 6(c) was encountered with units, the three marks in the mark scheme being allocated as follows :

12 x 2	1 mark
x time (either 60 or 1)	1 mark, dependent on 1st mark being correct
= 1440 J	1 mark , unit penalty (UP) applied

Question 8

This question was very poorly answered. Despite many correct answers in (a), some candidates were confused by the directions shown in the diagram and showed the blood flowing vertically.

In (b), candidates had no real idea and referred to cheapness or efficiency as an advantage of an electrical pump over a mechanical pump. Accredited answers included : 'no moving parts, no rotating coils, less wear and tear, less damage to body parts or pump' or any relevant disadvantages. Centres should be reassured that candidates' responses are looked at before the mark scheme is finalised and that any relevant response is credited in a case like this.

In (c) a misunderstanding of the terms 'hard' and 'soft' in magnetic terms led to a very common answer that 'soft magnetic materials are used so as not to damage the patient's body'. The more unfortunate 'soft magnetic materials are used so the pump switches off when it is no longer needed' also missed the point. Attention is required here because many candidates are also under the impression that hard magnetic materials produce stronger fields.

Very rarely, a candidate answered correctly but had clearly mixed up the terms 'hard' and 'soft'. Two out of three marks were then awarded.

Question 9

Questions from this part of the syllabus are always well answered and this was no exception.

In (a), most candidates scored the two marks for an explanation of 'isotope' and correctly stating that three isotopes of argon were shown on the diagram. The term 'element' is not acceptable instead of 'proton number' or 'atomic number'. Parts (b) and particularly (c) were well answered.

In (d), candidates must state the obvious that a half-life of 265 years in this context is 'long', because many who did not actually presented an argument showing that they thought it was 'short'.

Question 10

Parts (a) and (b) in which candidates calculated the frequency and wavelength of a wave produced by an earthquake, given its period and speed, was well answered despite a few unit errors.

Part (c) asked for the distance travelled and the time taken when the wave travelled from its epicentre to a point opposite on the Earth’s surface. Many candidates forgot to halve their calculated value of circumference and, unfortunately, many did not attempt the calculation for time taken. Many unit errors concerning m and km were seen.

Question 11

The mark in (a) was almost always scored for drawing a ray from a point object through a lens. In (b) candidates had to place three ticks alongside statements indicating the three correct ones out of five. Although a minority of candidates scored all three marks, many scored only two, with the first and fourth statements being most often ticked correctly.

Paper 2
General Comments

The paper contained a good range of questions which challenged the whole range of candidates and differentiated well. The majority of candidates were able to tackle all parts of all questions in the time allowed and presented their ideas reasonably well. There were still some candidates who had obviously only completed part of the course and so scored poorly on particular questions. Many of these would benefit from tackling past papers in advance of the examination to confirm whether they have reached an appropriate level of knowledge and understanding. Questions involving calculations were often answered well although units were often missed off or written incorrectly.

Question 1

The quality of answers often depended on the candidates’ examination centre and it was apparent where candidates had not seen experiments involving dynamics trolleys.

(a) (i) Most candidates were able to state that the dots were evenly spaced and that this meant the trolley was travelling at a steady speed. Very few realised that the three marks implied that a third point was expected and only the most able candidates gave a suitable answer. Part (ii) usually scored well but weaker candidates did not take account of the requirement to show all steps in the working and explain their reasoning. Most candidates read the distance correctly but some only measured a single gap and lost one of the measurement marks. Many were unable to determine the time correctly using the number of dots rather than the number of gaps. Those showing their working could still score the two marks for calculating the average speed using their distance divided by their time. Part (iii) revealed whether candidates had a correct understanding of the situation and many thought that the trolley would still travel at a faster, steady speed instead of accelerating. Answers stating that the gaps would get bigger were too vague and did not score the mark allocated for each gap being larger than the previous one.

(b) (i) In some centres candidates had not carried out this procedure and they tried to deal with it by adding more books, showing that they did not understand the requirement for a friction-compensated runway. They had to name apparatus that would allow them to provide a known force or a series of forces in equal steps. They also had to provide a different item appropriate to the investigation. Part (ii) was often answered well, but some good candidates may have spent more time on this than was justified by the six marks available. The best answers were often given as a list of the steps needed to carry out the procedure in a logical order. Part (iii) simply required candidates to state that for each different force the measurements should be repeated to ensure that they were correct.

Question 2

This question usually scored well where candidates knew the equations and read the question carefully.

(a) Parts (i), (ii) and (iii) scored well although candidates sometimes failed to give the correct unit or to square the speed in the kinetic energy calculation. Part (iii) scored the mark for calculating the difference between the two energies; weaker candidates who got a larger answer for (ii) than (i) frequently subtracted the larger from the smaller rather than checking their calculations. In (iv) many candidates gave a reason for the difference rather than stating what had happened to the energy, showing they had not read through the question before starting their answers.

(b) The introduction to the question used the term 'work done' and this should have pointed candidates to the correct method. Those who used the right method usually obtained the correct answer in (i). In (ii) the question asked for two frictional forces and candidates were expected to give specific answers. Many only wrote 'friction' again and so failed to score. Part (iii) also resulted in some vague answers.

(c) Part (i) was usually well answered but some candidates failed to calculate the weight and to write the answer separately. Part (ii) gave good candidates an opportunity to reason through a novel situation. They were expected to realise that the answer should be in the context of a question on pressure and that, since the weight remained constant, the smaller area would increase the pressure, that this would increase the friction and hence result in a slower speed. Full credit was given to those who reasoned that since the normal contact force would be the same, the friction with the ground and air friction would remain the same and hence the maximum speed would stay the same. Answers that stated the speed would increase did not score.

Question 3

This question often scored well for candidates who read the question carefully.

(a) In (i) and (ii) some candidates revealed a fundamental lack of understanding of the production of a spectrum and did not show correct dispersion and deviation at each of the surfaces. Most could identify the correct colours at each end of the spectrum but many could not indicate where infra-red could be detected. Good candidates could describe a simple procedure to detect infra-red in (iii) but there were many vague answers that failed to score.

(b) The candidates' choice of scale for the graph did not use the area of the paper fully, but smaller scales were allowed provided that candidates could read the value for 475 nm correctly. Centres should warn candidates that a poor choice of scale will continue to be penalised. Some candidates lost marks through missing off units on the graph axes. Centres should advise candidates to copy the table headings onto the graph axes. A few candidates ignored the instruction and started both axes at 0; this resulted in a straight line graph which, because the accuracy of plotting could not be checked, usually only scored one mark for labelling the axes. In (ii) and (iii) most candidates read the correct value from the graph and many identified this as blue or violet light.

(c) The calculation of angle was usually well done provided that the correct value of refractive index was used, but some candidates used 1.5, ignoring the value in the table. A majority of candidates gave the correct answer in (ii) but some lost marks through writing 'total internal refraction' rather than 'total internal reflection'.

Question 4

Answers to this question were variable and again varied between centres.

(a) This section scored well for candidates who knew the required relationships and who showed all steps in their working. Candidates who misread the time period were given credit for a correct calculation using their value. Part (ii) exposed any weakness in the understanding of the difference between displacement and distance. In all parts, marks were often lost through incorrect units.

(b) Most candidates scored well in (i) and (ii) but answers to (iii) were poor. Some candidates stated that the paint would break sooner but only gained credit if they supported it with a reason.

(c) In this section, too many candidates quoted properties of the different types of radiation rather than relating their answers to the novel situation shown. In (i), many immediately linked the lead screen to gamma or cosmic radiation or simply repeated the question, saying it protected the operator rather than preventing the beta radiation travelling directly to the detector. In (ii), answers just talked about alpha being absorbed by paper or gamma escaping, rather than alpha being absorbed by the paint or the 5 cm of air and gamma penetrating the paint and the material. In (iii), many stated that the beta radiation was deflected but failed to give a clear answer that this could prevent the radiation reaching the detector. Many candidates recognised that the reading in (iv) was due to background radiation.

Question 5

This question often scored well where candidates addressed the question asked and laid out their answers in a logical fashion.

(a) This section often scored all four marks although some candidates did not specifically refer to each ammeter. Good candidates often gave their answers in the form of a table that showed their intentions clearly.

(b) Many correctly chose circuit Q, but again there were vague answers or reference to series and parallel circuits.

(c) (i) The question required answers to show that the extender only worked up to a certain distance, so a method of measuring this distance was required.
(ii) Candidates who had thought about the situation gave good answers. Those who wrote their responses as a list rather than continuous prose often scored more marks.
(iii) Few candidates realised that once the distance became large the chime would not be heard and that some method for checking it was required.

(d) This section was often poorly answered. Weaker candidates tried to insert a piece of metal in one of the circuits rather than placing it between circuit Q and the extender. Again, those who wrote their answers as a list of steps in a logical order tended to score more marks.

PHYSICS 7540, GRADE BOUNDARIES

Grade	A	B	C	D	E
Lowest mark for award of grade	68	57	46	41	24

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demands of the question paper**.**

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