OCR
RECOGNISING ACHIEVEMENT

SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE **B752/02**

PHYSICS B

Unit B752: Physics modules P4, P5, P6 (Higher Tier)

MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 85

This document consists of 20 pages

Guidance for Examiners

Additional guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, eg mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

   / = alternative and acceptable answers for the same marking point
   (1) = separates marking points
   not/reject = answers which are not worthy of credit
   ignore = statements which are irrelevant – applies to neutral answers
   allow/accept = answers that can be accepted
   (words) = words which are not essential to gain credit
   <u>words</u> = underlined words must be present in answer to score a mark
   ecf = error carried forward
   AW/owtte = alternative wording
   ora = or reverse argument

   eg mark scheme shows 'work done in lifting/(change in) gravitational potential energy' (1)
   work done = 0 marks
   work done lifting = 1 mark
   change in potential energy = 0 marks
   gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

Question			Expected answers	Marks	Additional guidance
1	(a)		**B** (1)	1	if answer line is blank **allow** correct answer ticked circled or underlined
	(b)		because the droplets have no charge they do not repel (1) this means that the paint does not produce mist / fine spray (1) because the paint is not charged opposite to car, the car does not attract paint (1) this means that the paint is not attracted into the shadows / not an even coat of paint (1)	4	**answers must link no charge to effect on paint to gain full credit in this question** **not** paint does not stick to car
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
2	(a)		when current is too high for the computer, the 13A fuse will not melt / blow (1) this could result in overheating / damage / possible fire in the computer (1)	2	**both** needed **allow** power (1) **ignore** energy **not** voltage (1st answer) **not** fuse blows up / burns / snaps / leaks (2nd answer)
	(b)		third wire is for earthing or earth(ing)wire not needed (1) (because) case made of insulator or plastic so that it cannot become live (1)	2	 **allow** case does not conduct (1) **or** **allow** cannot normally give shock/prevents electrocution (1)
			Total	**4**	

Question			Expected answers	Marks	Additional guidance
3	(a)		ring around second diagram (side to side) (1)	1	**allow** two rings around 4th + 6th arrow (1)
	(b)		because ultrasound can give image of soft tissue which X-rays cannot (1) because ultrasound does not damage cells (1)	2	**allow** ORA **allow** non ionising (1) **allow** ORA **not** just less damaging / less harmful / safer
			Total	**3**	

Question			Expected answers	Marks	Additional guidance
4	(a)	(i)	720 (1) **second mark for how the half-life was calculated** two acceptable horizontal lines/indications eg 1000 and 500/800 and 400 etc. with corresponding values on the time axis indicated (1)	2	**allow** +**/-** 1 small square ie answer in the range 700-740
		(ii)	idea that uranium has a long half-life and so remains active in the body for too long (1)	1	
	(b)		$^{231}_{90}U \longrightarrow {}^{}_{}Th + {}^{4}_{2}\alpha$ both Th mass and atomic numbers correct (1) both α mass and atomic numbers correct (1)	2	
	(c)		no because medical and / or from inside the human body are not that much smaller (1) no because the data is an average and Stephen could have a particular medical condition / job (1)	2	**answers must support candidates choice to gain credit** **allow** yes because these values together make up 75% of the total (1) **allow** references to particular job eg radiographer or conditions eg cancer
			Total	**7**	

Question	Expected answers	Marks	Additional guidance
5	**Level 3** Answer thoroughly explains how gamma is used safely and the effect of the gamma radiation on the tumour and healthy tissue. Applies understanding of the risks of radiation and the benefits of treatment to explain in detail what the patient should consider including balancing risks against benefits of the treatment and the consequences of remaining untreated. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **Level 2** Answer explains some aspects of how gamma radiation is used and recognises the need to limit dose. Applies understanding of risks of radiation and benefits of treatments to address some risks and benefits in limited detail. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **Level 1** An incomplete explanation including gamma killing cancer cells. Identifies risks **or** benefits of treatment. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**relevant points include:** • beam is fairly wide and / or relatively weak • idea that γ can penetrate body to reach the tumour • idea that γ can kill cancer(ous) cells • idea that healthy cells can be damaged • rotation with tumour at the centre • gamma rays are focussed on the tumour • tumour receives dose from all angles • gamma does not penetrate through the same healthy cells due to change of angle with rotation • dose is limited to healthy tissues / cells risks and benefits • idea that a relatively small exposure a number of times • risk of damage to healthy cells/tissue • risk of side effects from treatment • benefit of treatment curing the cancer • risk that treatment may be ineffective • risk of cancer spreading / causing death if not treated • benefit of not suffering side effects / having to spend time in hospital if not treated **allow** answers in terms of tumour / cells / tissue **reject** references to chemotherapy
	Total	**6**	

Question			Expected answers	Marks	Additional guidance
6	(a)		because a polar orbit covers the whole of the Earth's surface over time (1) low orbit gives shorter orbital period (1) therefore idea that it can monitor changing weather patterns / can give early warning of potential dangerous weather situations (1)	3	**third marking point must be linked to either of the first two to gain credit** **allow** idea that low orbit allows higher resolution images (1)
	(b)		(geostationary satellites) need a longer orbital period (than imaging satellites) (1)	1	**ignore** just need 24 hours **but allow** comparison eg geostationary needs 24 hours but imaging need 1 hour / much less time to orbit (1)
	(c)	(i)	idea that force falls by a factor of 4 (1)	1	**allow** it is inversely proportional so falls by factor of 4 (1)
		(ii)	because the force increases as the comet approaches the Sun (1) this will cause the comet to accelerate/speed to increase (1)	2	**allow** answers in either order but must link increased force to increased speed to gain full credit
			Total	**7**	

Question			Expected answers	Marks	Additional guidance
7	(a)		15 (m/s) (2) BUT evidence of use of Pythagoras / scale drawing (1)	2	
	(b)		no (no mark) drop should be 45 m away (1) because the wind has a larger effect / 9x5 (1)	2	
			Total	**4**	

Question			Expected answers	Marks	Additional guidance
8			**Level 3** Answer thoroughly explains the path of the ball taking account of all forces, both horizontal and vertical effects and applies understanding of vector addition to explain the resultant velocity. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **Level 2** Answer partially explains the path using some appreciation of the force of gravity acting to change the velocity. The explanation should include application of vector addition in terms of the resulting path as a combination of horizontal and vertical velocities. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **Level 1** An incomplete explanation that may only mention one of the velocities in relation to gravity. Some appreciation that the direction of the velocities is important. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**relevant points include:** • horizontal velocity constant • vertical velocity increasing (in the downward direction) due to gravitational force • gravity is the only force (neglecting air resistance) once 'kicking' force no longer acting on the ball • no horizontal acceleration • constant vertical acceleration then • idea of vector addition for resultant velocity • resultant is the ever increasing downward velocity • mention of the fact that if air resistance were not ignored, horizontal velocity would decrease **allow** diagrams when answering the vector sum part of the answer **allow** correct reference to the equations of motion
			Total	6	

Question			Expected answers	Marks	Additional guidance
9	(a)		speed is greater in air compared to glass causing the bending away from the normal (2) **OR** speed changes / wavelength changes / AW (1)	2	**answer must identify where speed is greater to gain full credit**
	(b)		refractive index shows that blue light is travelling faster than red light in the glass (1) idea that amount/angle of refraction is higher for faster light / amount/angle of refraction is higher for higher refractive index / ora (1)	2	marking points may be in either order, candidate must link refractive index to speed of light and significance of speed difference to gain full credit
			Total	**4**	

Question			Expected answers	Marks	Additional guidance
10			because waves overlap an interference pattern is produced this can only be explained in terms of a wave model/theory / the particle model could not explain this interference pattern (2) **OR** idea of interference pattern produced (1)	2	**answers must link the interference pattern to the model which can explain it in order to gain full credit** **allow** higher level answers in terms of constructive and destructive interference **allow** higher level answers in terms of corpuscular or particle theory not being able to explain the interference pattern
			Total	**2**	

Question			Expected answers	Marks	Additional guidance
11			✓ × × ×	2	4 correct = (2) 2/3 correct = (1) 1 correct = (0)
			Total	**2**	

Question			Expected answers	Marks	Additional guidance
12	(a)	(i)	the resistance decreases **and** the brightness increases / AW (1)	1	**both** correct answers needed for the mark
		(ii)	9 (V) /✓ in second to last box (1)	1	if end column is blank **allow** correct answer ticked circled or underlined
		(iii)	because increased current increases collisions between charge carriers/electrons and atoms (1) this causes more atomic vibration / increased temperature / AW (1) more atomic vibration/higher temperature further increases number of collisions which means there is more resistance (1)	3	**marking points must be linked and in order to gain full credit** **allow** references to ions in place of atoms
	(b)		1.28 Ω (1)	1	if answer line is blank **allow** correct answer ticked circled or underlined
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
13	✎		**Level 3** Comprehensive explanation of the action of forces and of a broad range of methods for increasing speed. Application of knowledge about current and field to bring about a change in direction. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **Level 2** Limited explanation of the action of forces and of a range of methods for increasing speed. Application of knowledge about current or field to bring about a change in direction. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **Level 1** Explanation incomplete including factors that affect speed or direction. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**relevant points include** **forces** on the coil • forces in opposite directions on opposite sides of coil • produce rotation • sides at right angles to (magnetic) field for maximum force **speed** of rotation increased by stronger (magnetic) field • stronger magnets • higher current • more turns on coil/more turns/m • adding a (soft) iron core **allow** more powerful magnets higher voltage more coils bigger coil area **ignore** bigger magnets stronger current more wire **direction** of rotation • reverse direction of magnetic field • reverse current direction • interaction of current and field direction determines the direction of rotation **allow** swap magnets around reverse connections to electricity or voltage supply higher level answers making correct reference to Fleming's Left Hand Rule.
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
14	(a)		idea that resistance is reduced in higher light levels / AW (1) causing the speed to increase (1)	2	**allow** current increases (1) but resistance increases scores (0)
	(b)		3.75 (V) scores (2) **but if answer is incorrect** 5 x 36/(12 + 36) / 5 x 3/4 (1)	2	
			Total	**4**	

Question			Expected answers	Marks	Additional guidance
15			because the logic gates will be damaged due to exposure to high voltage/mains power (1) a relay should be used (1) because a relay isolates the logic gates and uses a low voltage from the logic gates to switch the high voltage to the motor (1)	3	**answers must link use of relay to isolating logic gates from mains power to gain full credit**
				3	

Question			Expected answers	Marks	Additional guidance
16	(a)		200 (2) **but if answer is incorrect** 4000 x (11 ÷ 220) (1)	2	
	(b)		idea of higher output voltage from transformer produces a lower current from I_s = IpVp / Vs / ORA / current at higher voltage less by a factor of 20 (1) **then** at higher voltage or lower current there is less heat / power / energy loss in cables because loss depends on I^2 / power loss less by a factor of $400/20^2$ (1) **then** idea that therefore low current decreases losses which increases efficiency (1)	3	**answers must be in correct order to gain full credit**
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
17			**Q** / **S** 0 / 0 1 / 0 0 / 1 1 / 0 1 / 0	1	all values need to be correct
			Total	**1**	

Question			Expected answers	Marks	Additional guidance
18	(a)		**any three from** idea that before testing started concentration levels of carbon-14 between 1940 and 1955 relatively constant showing that no other factor affected the levels (1) level increases (significantly/rapidly) between 1955 and 1963 which is during the testing of nuclear bombs (1) after 1963, levels start to decrease when testing stopped (1) makes link between more carbon-14 and increased background radiation level likely (1)	3	**allow** concentration of carbon-14 at 1 arbitrary unit between 1940 and 1955, which increases to 1.9 at its peak and then starts to decrease again after 1963 / AW (1)
	(b)		**any one from** concentration level of carbon-14 'fluctuates' at 1.22 units / there is more than one year on the graph at 1.22 units so cannot be certain which year 'value' to choose (1) **and** idea of repeating process using concentration levels of carbon-14 in other teeth to check for consistency in predictions (1)	2	**allow** graph indicates two different years one in 1960 and one in 1985 **allow** repeating with other teeth where the value does not fluctuate (1)
	(c)		**any two from** quite accurate / reliable / close to actual date in middle of graph (1) older teeth are estimated as being too old (1) younger teeth are estimated as being too young (1)	2	**allow** idea that not all the estimates are accurate (1) **allow** worse when the teeth are older or younger (1) **allow** not so accurate / not reliable on older teeth or younger teeth (1)

Question			Expected answers	Marks	Additional guidance
18	(d)		no (no mark) because the carbon-14 will not have decayed much / AW (1)	1	
	(e)		**carbon 14 test** **teeth wear test** ✓ × × × × ✓	2	six correct = (2) four or five correct = (1)
			Total	**10**	