OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B752/01

PHYSICS B

Unit B752: Physics modules P4, P5, P6 (Foundation 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)		no (no mark) the brown is live wire so this would mean that the fridge will not work and the casing/fridge would become live if brown was connected (2) **OR** the brown is live wire / green yellow is the correct earth wire / AW (1)	2	if answer is 'yes' no marks **answer must link identification of brown wire to effect on the fridge to gain full credit** **allow** the green-yellow is the correct earth wire but if this is connected to the live connection the casing/fridge would become live (2)
	(b)		blue and brown (1)	1	if answer line is blank **allow** correct answer ticked circled or underlined
	(c)	(i)	(as resistor is in series the current) halves /1.5 (A) (1)	1	**ignore** just falls / AW
		(ii)	protect bulb by: fuse / circuit breaker to protect the lamp **if** current gets too high (1) increase brightness by: add more cells / batteries, which increases voltage / higher current flows (1) remove resistor already in circuit so higher current flows (1) use variable resistor **to** vary the brightness by varying the current (1)	3	**answers must link component to how this affects the current/voltage/bulb for each marking point** **allow** use lower (value) resistor (1) **allow** description of variable resistor eg decrease length of wire / increase thickness of wire / ora (1)
			Total	**7**	

Question			Expected answers	Marks	Additional guidance
2	(a)		diagram correctly drawn to show shorter wavelength (1)	1	**not** any change in amplitude
	(b)		scans / pregnancy scan / AW (1) to check development of foetus / (unborn) baby (1) **OR** blood flow measurements (1) to check circulation system / heart is pumping correctly (1) **OR** breaking (kidney) stones (1) so they can pass out the body easily / avoids need for surgery or general anaesthetic (1)	2	**allow** examples of foetal development e.g. check heart or brain is normal (size) (1) **allow** look for tumours (1) to target treatment (1) **allow** cleaning (medical) equipment (1) so that idea that particles are removed (1) **allow** to treat muscle injury (1) so allows quicker healing process (1) **allow** cancer treatment or HIFU (1) as avoids need for surgery or general anaesthetic / chemotherapy or radiation (1)
	(c)		because it emits gamma, which penetrates the skin, it will be possible to trace it through the skin (1) because it has a short half-life it will, decay quickly / stop producing ionizing radiation quickly, so will minimise damage to tissues/risk (1)	2	
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
3	(a)		the number of nuclear decays emitted (1)	1	**allow number of nuclear decays detected** (1) **ignore** idea of per second or per minute
	(b)		(background radiation from) rocks / cosmic rays (1)	1	**allow** reference to (waste from) hospitals / industry (1) **ignore** just nuclear power stations
	(c)	(i)	the time taken for the activity of the source to halve (1)	1	**not** just 'it halving' **allow** time for the activity to decrease by a factor of 2 (1)
	(d)	(ii)	no (no mark) because it reaches the background radiation level before it halves (2) **but just** (activity) does not halve (1) **OR** idea of line levelling out (before it halves) (1)	2	 **allow** higher level correct quantitative answers e.g. starts with an activity of 95 and never falls below 50 (1)
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
4			**Level 3** Detailed explanation of how charge is useful, in terms of paint droplets repelling and car attracting, and including the effect on the end result, and applies understanding of charges to explain how dangers could be reduced. 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 how charge is useful, using the idea of opposite charges attracting. Applies understanding of charges to give some suggestion of how dangers could be reduced. 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 answer explaining few aspects of the process. Dangers identified in terms of risk of shock from electrical current. 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:** • paint gun charged • car body earthed/opposite charge to paint • paint charged by paint gun • droplets all have same charge • (paint) droplets or particles repel/fine mist formed then • paint attracted to car/body/object • all of car painted including 'shadows' • even coat produced/no runs in paint and • risk of large charge flowing to earth through people • results in an electric shock • need to isolate charge • insulating footwear could reduce dangers • risk of inhaling vapour from paint • wearing a mask over the nose and mouth **allow** answers in terms of paint positive/car negative ORA **ignore** reference to nice finish **ignore** paint sticks to car
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
5			idea it is (a model of) a chain reaction (1) idea that the reaction is controlled in a nuclear power station **and** is out of control in a bomb (1)	2	**allow** fission
			Total	**2**	

Question	Expected answers	Marks	Additional guidance
6	**Level 3** Answer clearly describes forces involved in orbiting satellites. Answer gives a broad range of satellite uses and explains which orbits are suitable with detailed reference to a number of characteristics. 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 gives a range of satellite uses with some description of the different types of orbit **and** at least one linking of characteristic included. 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 answer that gives a use of satellites and recognises a difference between types of orbit. 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:** • gravitational force needed to maintain orbit • lower speed at higher orbit and v.v. • orbits include geostationary/fixed position/equatorial and polar • lower orbits tend to be used for polar orbit satellites • higher orbits tend to be used for equatorial/geostationary orbit satellites uses • communications • weather forecasting • military/spying • research • GPS links for characteristic of orbit to use • polar orbits view different areas of the Earth eg for spying • lower orbit increases the rate of image updating eg for weather forecasting • lower orbit results in a higher period/speed which means the same point on Earth is covered more often/frequently eg for GPS • geostationary orbits are in a fixed-position over the Earth eg for TV satellite communications/weather forecasting • higher the orbit the greater the ground coverage eg for TV or radio
	Total	**6**	

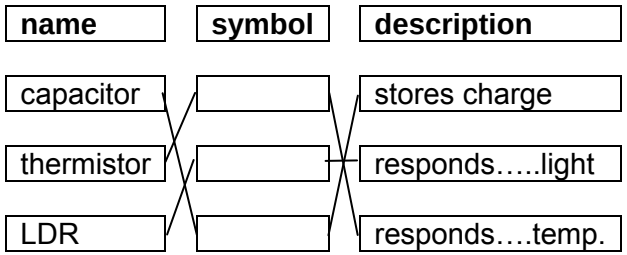
Question			Expected answers	Marks	Additional guidance
7	(a)		(relative speed) decreases / AW (1) because the cars were moving in the opposite direction / apart, but now they are moving in the same direction (1)	2	**allow** from 17 to 7 m/s or 12 m/s + 5 m/s (1)
	(b)	(i)	300 (m) (2) **but if answer is incorrect** average speed (10 or {15 + 5} ÷ 2) or correct working (10 x 30) (1)	2	
		(ii)	360 (m) **and** (yes), because 300+10<360 / distance travelled by car **X** is greater than the distance travelled by car **Y** and the starting position 10m behind (1)	1	both calculation and explanation needed for the mark **allow** ecf from part (i)
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
8			no (no mark) because the range increases as the angle increases to 40° but then the range decreases (1) because the optimum angle is 45° (1) **then** because increasing the angle increases the time the ball spends in the air but decreases the horizontal velocity (2) **OR** increasing angle increases the time the ball spends in the air / increasing angle decreases horizontal velocity (1)	3	**allow** max 1 mark for comments relating to fair testing or experimental method eg he didn't kick the ball equally hard each time / he didn't do repeats and get an average linking the effect of increasing angle to time and horizontal velocity is worth 2 marks **allow** answers in terms of at high angles more energy being used to move the ball upwards than across (1)
			Total	**3**	

Question			Expected answers	Marks	Additional guidance
9	(a)		**D** and **E** (1)	1	any order
	(b)		light is <u>refracted</u> (1)	1	tick in fourth box
	(c)		light is reflected (internally and correct side of the normal) correctly with reflected angles equal to incident angle by inspection – margin of error +/- 2^{o} (1)	1	any refracted light shown on diagram scores zero
			Total	**3**	

Question			Expected answers	Marks	Additional guidance
10	(a)		light travels... (✓) light can bend... × EM longitudinal… ×	1	2 correct = (1) 1 correct = (0)
	(b)		idea of he hears loud and quiet areas / quiet or soft area followed by louder area followed by quiet or soft area (1) because of the overlap of waves from the two speakers (1)	2	**allow** different loudness (1) **allow** sound and no sound (1) **allow** higher level answers in terms of constructive and destructive interference (1)
	(c)		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

Question			Expected answers	Marks	Additional guidance
10	(d)		no (no mark) idea that signal **B** will be **reduced in strength** because of atmospheric effects and so will not pass through (1) idea that signal **A** will be **reflected** because it is below 30 MHz (1) idea that signal **C** (10 GHz) is in the band that can **pass through** the atmosphere so can be used (1)	3	**for full credit answers must link signals with their behaviour in the atmosphere**
			Total	**8**	

Question			Expected answers	Marks	Additional guidance
11	(a)			2	name symbol and description all linked correctly all three correct 2 marks one or two correct 1 mark
	(b)	(i)	AND gate (1)	1	
		(ii)	inputs at **A** & **B** are to the base connector, and allow current to pass through each transistor (1) input at **A** allows current to reach collector of 2nd transistor (1) input at **B** allows current to reach the 'Out' terminal (1)	3	**ignore** truth table, answers must describe behaviour of each transistor to gain full credit
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
12	(a)		thermistor (1) because changing the temperature changes the current / AW (1) and the change in current shows that the resistance must have changed (1) changing light level has no effect / AW (1)	4	**answers must link temperature, resistance and current to gain full credit for this question** **allow** 'changing the temperature, will change the resistance of a thermistor, and this change in resistance will cause a change in the current in the circuit' (2) as an alternative to 2nd and 3rd marking points **allow** cannot be LDR as an LDR does not respond to temperature (change) (1)
	(b)	(i)	4 (1) ohms/Ω (1)	2	
		(ii)	resistance is not constant / increases (at higher currents) / ora (1) the graph is a curve / not a straight line / gradient of graph is changing / AW (1)	2	**allow** higher level answers above target level eg because V is not directly proportional to I, R must be changing (1)
			Total	**8**	

Question			Expected answers	Marks	Additional guidance
13	(a)		by placing the wire in complete circuit with the ammeter and moving the magnet/wire (1) this will show a current because there will be a reading on the ammeter (1)	2	magnet must **not** be in the circuit for the complete circuit mark **allow** higher level answers eg move the wire so it cuts the magnetic field (1)
	(b)		step-down transformer (1)	1	step-down needed for the mark
			Total	**3**	

Question			Expected answers	Marks	Additional guidance
14			**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 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/per 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
15			1 (row 3) (1) 0 (row 4) (1)	2	
			Total	**2**	

Question			Expected answers	Marks	Additional guidance
16	(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)		concentration level of carbon-14 'fluctuates' at 1.22 units / there is more than one year on the graph at 1.22 units (1) so cannot be certain which year 'value' to choose (1)	2	**allow** graph indicates two different years one in 1960 and one in 1985
	(c)	(i)	because there are more than 10 points plotted on the graph (1)	1	

Question			Expected answers	Marks	Additional guidance
16	(c)	(ii)	**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)
		(iii)	test more teeth from people of different ages (1) Idea that estimates are better when based on more data (1)	2	 **allow** because graph shows gaps in the data (1)
			Total	**10**	