OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B751/01

PHYSICS B

Unit B751: Physics modules P1, P2, P3 (Foundation Tier)

MARK SCHEME

Duration: 1 hour 15 minutes

MAXIMUM MARK 75

This document consists of 16 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)		12 000 J heating the room(1) 8 000 J wasted (1)	2	 **allow** ecf for wasted energy if wasted + heating add up to 20 000 J
	(b)		concept (no mark) because Concept is the only model where payback time is less than 10 years and this means that Asif saves most money (£100) over 10 years with the Concept (2) **OR** because Concept is the only model where payback time is less than 10 years / over 10 years Asif saves the most money with the Concept (1)	2	concept not chosen or incorrect model chosen answer scores (0) **allow** correct use of figures eg paid £600 and get £700 back in savings at the end of 10 years (1) **allow** although Aspect is more efficient / saves more on fuel each year, Aspect costs more than the Concept (1)
			Total	**4**	

Question			Expected answers	Marks	Additional guidance
2	(a)		idea of distance between **A** and **D** (1)	1	**both** letters needed (either order)
	(b)	(i)	2.5 (m/s) (2) **but if answer is incorrect** 2 X 1.25 (1)	2	
		(ii)	estimated depth of water within the range of 0.3 – 0.9 (m) (1)	1	**allow** ecf from part (b)
			Total	**4**	

Question	Expected answers	Marks	Additional guidance
3	**Level 3** A detailed description of the three processes by which energy is transferred from inside to outside and how energy losses are reduced using cavity wall insulation. Applies knowledge of how inclusion of shiny foil reduces energy loss in the context of a cavity wall. 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 description of some processes by which energy is transferred, order from inside to outside may be confused, some reductions by cavity walls described but not linked to different forms of transfer. 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 description, naming some processes by which energy is transferred. 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:** • cavity wall insulation slows down the process of heat transfer • cavity wall insulation retains more heat inside the home • energy moves by **conduction** through the internal blocks • foam or air is a poor **conductor** / foam or air is a good **insulator** so energy transfer is reduced • air/bubbles trapped (in foam) reduces **convection** • reduces heat or energy **radiated** into cavity • inner silver foil surface reflects heat or IR back • outer silver foil surface emits less heat • energy moves by conduction through the external bricks **accept** cavity wall insulation reduces energy losses mainly by conduction and convection **ignore** heat escapes **reject** heat particles
	Total	**6**	

Question			Expected answers	Marks	Additional guidance
4			sunburn/skin cancer/premature skin aging (1) spend less time in the sunshine (1) <u>use a higher factor</u> sun cream / block (1)	3	**allow** excessive sun tan (1) **allow** put on a hat / sit in the shade (1)
			Total	**3**	

Question			Expected answers	Marks	Additional guidance
5	(a)		infrared sensors are sensitive to heat, and can detect objects that are warmer than their surroundings(1) the burglar gives out body heat and so is warmer than the surroundings, and the curtain is not (1)	2	marking points in either order can gain credit 'infrared sensors detect body heat' alone is worth 1 mark **ignore** the curtain is not hot
	(b)	(i)	correct table 0 1 0 1 0 1 1 1 0 0 (1)	1	
		(ii)	it has continuously varying values (1)	1	**allow** it is not only on or off / it is not only 0 or 1
	(c)		advantage: increased speed of communication compared to runner / digital signal used so easier to remove interference (1) disadvantage: idea of need for a code / need for technology to support use of light (at transmitter and receiver) (1)	2	**allow** faster / quicker communication (1) **allow** higher level answers above target grade eg allows use of multiplexing (1)
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
6	(a)		because the solid is melting (1)	1	**allow** higher level answers above the target grade eg energy supplied is used to break bonds between molecules (1) **ignore** changing state
	(b)		because the gas (made during boiling) is heating up / liquid has all boiled in part **D** or previous part of graph (1)	1	
			Total	**2**	

Question			Expected answers	Marks	Additional guidance
7	(a)		mains electricity is distributed from power station to consumers (1) via **national grid /** via a **network** of power cables on pylons (1)	2	**allow** example of consumer types – homes, factories, businesses etc.
	(b)		0.33 or 33% (2) **but if answer incorrect** 2/6 (1)	2	**allow** 1/3 (2) correct substitution into correct equation will score (1) if answer is incorrect **allow** correct number with incorrect unit eg 33MW/0.33MJ (1)
	(c)	(i)	(chart shows) tidal power is (slightly) less efficient than hydroelectric and is (a lot) more efficient than nuclear / wind / geothermal / oceanic thermal conversion (1)	1	
		(ii)	needs a scale / need to show efficiency as a ratio / percentage / displayed as a bar chart with figures on it (1)	1	
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
8			she should make predictions based on her hypothesis (1) then she should test her predictions / gather more data / gather more evidence (1) compare this new data to her original prediction (1)	3	**marking points must be in correct order to gain full credit for this question** **allow** idea of using a more accurate telescope (1) **allow** examples of the type of evidence she should gather eg to show the effects of a black hole (1) **allow** (conclusion) not been peer reviewed/checked by other scientists (1) as alternative to any of the marking points
			Total	**3**	

Question			Expected answers	Marks	Additional guidance
9			**Level 3** A balanced answer, including arguments for **and** against using photocells, arguments are developed to explain their relevance and linked to the context in the question. 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 includes arguments for **and** against using photocells; arguments are limited in detail and relevance not fully explained. 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** Answer includes arguments for **or** against using photocells, arguments are simplistic. 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:** **arguments for** • light energy from the Sun is transferred into electricity • able to produce direct current (DC) • can operate in remote locations like a park • low maintenance • no need for power cables • no need for fuel • long life • renewable energy source • no polluting waste • not dependent on National Grid for electricity • can generate surplus electricity to sell to electricity companies **arguments against** • amount of sunlight that arrives at the surface on Earth is not constant • amount of light available depends on location, idea that could be covered by trees in a park • amount of light available depends on time of day • amount of light available depends on weather conditions • as the Sun does not deliver that much energy to any one place at any one time, a large surface area is required to collect the energy at a useful rate. **example of simplistic approach:** • amount of light available depends on time of day **example of developed approach:** • amount of electricity produced depends on the amount of light available so no electricity is produced at night (when it is dark)
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
10	(a)		0.805 (kilowatts) (2) **but if answer incorrect** 230 x 3.5/1000 (1)	2	**allow** 0.8/0.81 (kilowatts) (2) **allow** answer in table or on answer line
	(b)		**appliance that costs most to run** washing machine (1) **because** **any one from** 0.5 x 8 = 4 (kilowatt hours) which is the highest value (1) cost depends on power rating and time switched on and the washing machine is on for a long time with (quite a) high power (1)	2	**allow** formula cost = time x power (x cost per kilowatt hour) (1)
	(c)	(i)	DC / direct current (1)	1	
		(ii)	National Grid supplies AC (battery supplies DC)/AW (1) National Grid has a higher voltage/ora (1)	1	**allow** higher level descriptions of how power is generated eg National Grid uses power from a generator and battery does not (1)
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
11	(a)		alpha would not be able to penetrate the skin and so would not reach a detector outside the body (2) **OR** alpha would not be able to penetrate the skin / alpha would not reach the detector (1)	2	answers must link penetration of alpha to reaching detector outside the body to gain 2 marks
	(b)		wear protective clothing (1) use tongs / keep her distance (1) short exposure time (1) shielded / labelled storage (1)	2	**allow** lead shield / lined apron (1) **ignore** lab coat / goggles
			Total	**4**	

Question			Expected answers	Marks	Additional guidance
12	(a)		straight horizontal line / between 0 and 2 seconds shows: zero speed / not moving / stationary (1) straight line gradient / between 2 and 8 seconds shows: steady speed (1) less steep gradient / between 8 and 12 seconds shows: slower steady speed / ora (1)	3	**allow** standing still (1) **allow** Brian does not move for 2 seconds, then drives fast for 6 seconds, and drives slower for 4 seconds. (2) as no reference to steady speed
	(b)	**(i)**	no because average speed is 12.5 m/s (1)	1	**mark is for evidence of calculation to support answer**, not simply for stating 'no'
		(ii)	yes (no mark) because he was stationary for some of the time so for other times he was going faster than his average speed / idea that gradient changed so at some points in journey he was going faster than the average speed (1)	1	**allow** higher level answers above target grade where speed is calculated for part of the journey
	(c)		the time taken to travel the journey will be double (1)	1	
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
13	(a)	(i)	3.33 or 3 1/3 (1) m/s^2 (1)	2	**ignore** more than 2 decimal places **allow** 3.3
		(ii)	idea of greater speed change (in same time / 3 seconds) (1)	1	
	(b)		thinking distance + braking distance (1) to know how much distance to leave between cars / to avoid a crash when braking (1)	2	**allow** description of the two distances (eg thinking distance = distance travelled whilst reacting/before putting brakes on) but **both** needed (1) **allow** for road safety (1)
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
14	**(a)**		6.9 (kilometres per litre) (1)	1	**allow** answer in table or on answer line
	(b)		driving condition **B** gives the best fuel consumption because it has the best shape/ is more aerodynamic/is streamlined (1)	1	**allow** driving condition **B** gives the best fuel consumption as windows closed and deflector fitted (1)
	(c)		Ronan has got fuel consumption back to front – more km per litre is better / AW (1) **no mark for choice of car, marks are for valid reasons** most economical/lowest economic impact is vehicle **V** OR best fuel consumption/lowest cost for fuel is car **V** (1) environmental impact is a choice between **Z** quietest and **V** lowest CO_2 emissions (1)	3	**allow** idea that car **Z** will go the shortest distance on a set amount of fuel (1) **answers must support choice of car to gain credit**
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
15			**Level 3** Detailed explanation of reasons for fitting seat belts and replacing them after crashes including application of energy and detail of damage to seat belts. 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 reasons for fitting seatbelts and replacing them after crashes including some reference to the type of damage to the seat belt. 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 attempted explanation of reasons for fitting seatbelts and replacing them after crashes; references do not go beyond the idea of protecting the driver OR that the seat belt is damaged. 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:** **how seat belts work** • seat belts are intended to protect all the passengers wearing them in the event of an accident • by absorbing energy when vehicles stop • by reducing the force on the wearer • because the momentum change is spread over a longer time • reducing injuries for wearers **accept** examples of how seat belts protect, eg seat belts keep you in your seat/stop you hitting the windscreen **why they have to be replaced** • seat belts are damaged in a crash • as energy is absorbed seatbelt (deforms) changes in shape • some damage to seat belts is irreversible • idea of 'one time use' / repeated damage could cause seatbelt to break / seatbelt won't be as strong after an accident • damage to anchor points, belt locking mechanism etc, • damage may not be easily visible, so replace to minimise future risk **accept** examples of specific damage eg seat belts lock in a crash **accept higher level answers** eg seat belts spread the stopping force across ribs and pelvis/stronger parts of body seat belt webbing is a flexible material
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
16	**(a)**		terminal (speed) (1)	1	**allow** terminal (velocity)
	(b)		initially Britney's speed increases and frictional forces increase with speed (1) when the forces are balanced, her speed is steady / does not change (1)	2	**allow** answers in terms of acceleration **allow** alternative terms for frictional forces (drag, friction, air resistance) for second marking point candidates must link balanced forces to steady speed **ignore** up thrust
			Total	**3**	