OCR
RECOGNISING ACHIEVEMENT

GCSE

Physics B

General Certificate of Secondary Education

Unit **B751/02:** Modules P1, P2, P3 (Higher Tier)

Mark Scheme for June 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

For answers marked by levels of response:

a. **Read through the whole answer from start to finish**

b. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor

c. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

d. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Annotations

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	contradiction
	Level 1
	Level 2
	Level 3

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
allow	=	answers that can be accepted
not	=	answers which are not worthy of credit
reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant
( )	=	words which are not essential to gain credit
__	=	underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
ecf	=	error carried forward
AW	=	alternative wording
ora	=	or reverse argument

SECTION A

Question			Answer	Marks	Guidance
1	(a)		most heat lost from hot / poorly insulated areas **indicated by** colours white / yellow / red (1) least heat lost from cool / well insulated areas **indicated by** colours black / dark blue / purple (1)	2	must correctly link heat loss area to correct colour must correctly link heat loss area to correct colour look also for a combination of ideas: eg red areas are hot and lose most heat, purple areas are cold (2) if no mark awarded idea of white is hotter **and** dark is colder scores (1)
	(b)		**all 4** payback times correct in table or elsewhere in answer 48 / 6 / 3 / 2 (1) **then** idea that they (C and D) have a short / low payback times (1) they (C **and** D) • save more (annually than A and B) / AW • are cheaper to fit (than A and B) / AW • reduce energy losses by 50% / AW (1) maximum of (1) for each marking point	3	**eg** D – greatest annual saving (1) **eg** C is cheapest to fit (1)

Question			Answer	Marks	Guidance
	(c)	(i)	70% (3) **but if answer is incorrect** (7000 ÷ 10000) x 100 (2) **but if this is incorrect** useful energy = 7000(J) (1)	3	**ignore** 0.7 on answer line unless % clearly crossed out and no other unit added 0.7 **on its own** scores max (2) alternatively **allow** (3000 ÷ 10000) x 100 (1)
		(ii)	idea that wasted energy is given to surroundings / atmosphere / energy is conserved / AW (1) wasted energy and useful energy add up to input energy (so not totally lost/energy just transferred) / AW (1)	1	**allow** idea that 3000J / wasted energy is converted to different forms of energy (1) Eg. 3000J lost as heat (1) **ignore** lost as sound **allow** the idea of energy conservation (1) **eg.** 7000J + 3000J output = 10000J input eg. combined width / size of output arrows = input (1)
			Total	**9**	

Question			Answer	Marks	Guidance
2	(a)		**Level 3** Answers should include the mechanisms of IR **AND** microwave cooking **causing** the relevant particles **to gain KE**. Also the answer should give a clear explanation of how IR cooking needs more energy or takes a longer time. **Quality of written communication does not impede communication of the science at this level.** **(5–6 marks)** **Level 2** Answers should include the simple mechanisms of IR **AND** microwave cooking causing the relevant particles to heat up. Also the answer should give some explanation of how IR cooking needs more energy or takes a longer time. Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **Level 1** Answers should include a simple mechanism of IR **OR** microwave cooking causing the relevant particles to heat up. Quality of written communication impedes communication of the science at this level. **(1–2 marks)** **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted up to A*** **Indicative scientific points may include:** **Level 3:** • (microwaves) penetrate the food and are absorbed by water / fat particles which **gain KE / vibrate or move faster** • (microwave) less energy / cooking time needed as energy only used to heat food • (IR) only heat surface particles which **gain KE / vibrate or move faster** • (IR) idea that more energy / cooking time needed as oven / dishes need heating first • conduction to centre (for either type of wave) involving **transfer of KE or movement between particles** / AW • less food heated by conduction or convection with microwaves so less energy / cooking time needed **Level 2:** • (microwaves) penetrate the food and heat water / fat particles • (microwave) less energy / cooking time needed as energy only used to heat food • (IR) only heat surface particles • (IR) idea that more energy / cooking time needed as oven needs heating first **Level 1:** • (microwaves) heat the water / fat particles • (microwave) reflect from oven walls • (IR) only heat surface particles • (IR) idea that IR waves heat the oven / dishes • (microwaves) more efficient • microwaves penetrate further than IR **ignore** characteristics **not** on mark scheme

Question			Answer	Marks	Guidance
	(b)		comment on the data in terms of any **one** from: • less people studied / less evidence in A compared with C • shorter time study in A compared with C • more research for mobile phones than against • study about old people / not about young people (eg C) • idea that study about human / rat cells may not be representative or reproduced in humans (B) (1) • conflict in conclusions (eg A&B or B&C) **then** consideration of the risk against the possible benefits (1)	2	eg idea of safety / social interaction for children / young people / teenagers versus risk of use (1)
			Total	**8**	

Question			Answer	Marks	Guidance
3			300 (seconds) to 500 (seconds) (1) energy used to break intermolecular bonds / bonds between molecules (1)	2	**allow** 300 to 310 (1) **allow** overcome intermolecular forces **ignore** breaks intermolecular forces **not** intra-molecular forces **ignore** bonds between particles **allow** breaks bonds between liquid particles (1) both marking points are independent of each other
			Total	**2**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td>(i)</td><td>1.5 x 10^{14} (Hz) (2)

but if answer is incorrect

2.2 x 10^{8} ÷ 1.5 x 10^{-6} (1)</td><td>2</td><td>1.47 x 10^{14} (2)
allow other Hz prefixes eg 1.5 x 10^{8} MHz/150THz
if multiple clearly shown on answer line

allow 1.4666 x 10^{14} (1)
allow 146666660000000 (1)</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th></th><th>> in fibre</th><th>= in fibre</th><th>< in fibre</th></tr><tr><td>speed of IR in air</td><td>✓</td><td></td><td></td></tr><tr><td>wavelength of IR in air</td><td>✓</td><td></td><td></td></tr><tr><td>frequency of IR in air</td><td></td><td>✓</td><td></td></tr></table></td><td>2</td><td>all 3 correct (2)

1 or 2 correct (1)</td></tr>
<tr><td></td><td>(b)</td><td></td><td>max one from standard demand marks:
rapid (high rate) of transmission of data (1)
idea that it is easier to remove noise (1)

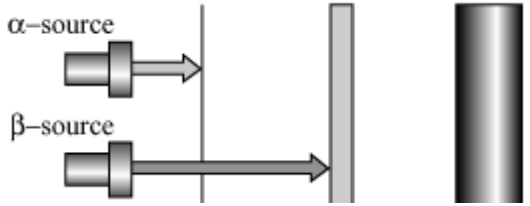
any two from higher demand marks:
multiple signals / more information transmitted / multiplexing (1)
output signal / sound / picture is clearer (1)

noise not recognised or amplified (1)</td><td>2</td><td>ignore interference can be removed

ignore less interference in signal

allow interference is not recognised (1)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

SECTION B

Question			Answer	Marks	Guidance
5	(a)		arrow or line from alpha to front / rear face of paper and arrow or line from beta to front / rear of aluminium (1)	1	**allow** alpha line slightly penetrating paper and beta line slightly penetrating aluminium but not passing all the way through  Do **not allow** mark if radiation emerges from barrier
	(b)		**any two from:** treating or curing cancer / killing cancerous cells / radiotherapy (1) non-destructive testing (1) tracers (1) sterilising equipment/killing bacteria on surgical equipment (1)	2	**not** chemotherapy **ignore** nuclear weapons **allow** industrial, environmental or medical benefits Eg testing for leaks in pipes (1) smoke detectors (0)

Question			Answer	Marks	Guidance
	(c)		**any two from the ideas that:** (as gamma is highly penetrating) it must be placed in a material resistant or thick enough (to stop the radiation penetrating) (1) long term containment needed (1) it may remain radioactive for a long time so long term solutions are required / AW (1) it must be stored where there is no possibility of it contaminating water supply (1) they need to monitor levels of radioactivity for long periods of time (as acceptable radioactivity levels may change over time) (1)	2	Eg. **encased** in glass (1) Eg. placed **deep** underground (1) Eg, long half lives mean so container must not corode (2) **allow** long time to decay (1) **but** long time to decompose (0) **allow** idea of terrorist risk Eg. terrorist use plutonium (1) Eg terrorist use it to make a bomb / dirty bomb (1)
			Total	**5**	

Question			Answer	Marks	Guidance
6			**Level 3** A clear description and reason why it is unusual for asteroids to be NEOs **AND** a clear description of the possible actions that could be taken to reduce the threat of this asteroid. **Quality of written communication does not impede communication of the science at this level.** **(5–6 marks)** **Level 2** A general description about why it is unusual for asteroids to be NEOs **AND** a limited description of the possible actions that could be taken to reduce the threat of this asteroid. **Quality of written communication partly impedes communication of the science at this level.** **(3–4 marks)** **Level 1** A general description about why it is unusual for asteroids to be NEOs **OR** a general description of the possible actions that could be taken to reduce the threat of this asteroid. **Quality of written communication impedes communication of the science at this level.** **(1–2 marks)** **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted up to grade A** **Indicative scientific points may include:** **why is it unusual for asteroids to be a threat** • unusual for predicted trajectory to be with the Earth as Earth is so small compared with space/probability idea • most asteroids orbit between Mars and Jupiter • (idea that) most small asteroids 'burn up' in the Earth's atmosphere before they reach the Earth • unusual for asteroids to be near the Earth **possible actions that could be taken to manage the threat of this asteroid** • predict the trajectory • constant surveys by telescope • constant monitoring (by satellites / scientists) • could be deflected by explosions • (idea that) explosion need to be distant to the Earth so the explosion does not damage the Earth • if going to use an explosion need to do so soon as 2019 is not that far away • difficult to deflect 2002 NT7 because of large size or mass • easier to deflect away from collision further away from Earth. Use L1, L2, L3 annotations in scoris; do not use ticks.
			Total	**6**	

Question			Answer	Marks	Guidance
7	(a)		**any two from:** idea of renewable energy (1) idea of no polluting waste produced (1) crops can be grown under them / placed at sea (1) useful in remote locations (1) (idea that) new technology are making wind turbines more efficient (than conventional power stations) (1)	2	**allow** does not need **fossil** fuels or named fossil fuel (1) **allow** no carbon dioxide produced / no greenhouse gases (1) allow idea of less global warming (1) **allow** idea of less maintenance / labour or staff required (1) **allow** generation close to consumer / AW (1) **ignore** pollution unless qualified
O/L	(b)	(i)	as wind speed increases the noise increases / ora (1)	1	
		(ii)	idea of: for **low** speeds / up to 5 m/s / up to mean speed - the noise level is below background / 33dB (1) idea of: for **high** speeds / above 5 m/s / above mean speed - the noise level is generally below / not much above background (1)	2	**allow** 'most dots below background (1) **eg.** 'turbine noise less than tree noise' (1) **eg** 'at high wind speeds the noise is rarely above background' (1) **allow** (if no other marks obtained) normal background is usually higher than turbine noise (1)
			Total	**5**	

Question			Answer	Marks	Guidance
8	(a)		0.115 (kW) (2) **but if answer incorrect** 0.5 x 230/1000 (1) **or** 115 (1)	2	**allow** 0.11/0.12 (kW) (2)
	(b)		5 (hours) (2) **but if answer incorrect** 0.45 / 0.09 (1)	2	 **allow** 0.45 / 90 or 0.005 (1)
	(c)		monitor desktop PC (keyboard) mouse (1)	1	all 3 correct = 1 mark
	(d)		Correct idea from Fatima **AND** a correct idea from Claire (1) **AND** any **one** from • idea that it depends on the number of people taking up these initiatives (1) • Claire's idea is impractical (1)	2	Eg. Fatima's and Claire's idea • reduce global warming • or use less energy • or use less (fossil) fuels or resources used • or reduce greenhouse gases / CO_2 eg. would only apply to short / local journeys (1) eg. unrealistic that people would give up using cars (1) eg. some vehicles essential, eg health reasons / jobs / living in country (1)
			Total	**7**	

Question			Answer	Marks	Guidance
9	(a)		500 000 (MJ) (1)	1	
	(b)		idea that readings change each side of the 0 / idea that readings are positive and negative or flow in two directions (during a cycle) / AW (1)	1	**ignore** merely up and down / same frequency, etc. **ignore** merely 'all have peaks and troughs' **allow** all change (in) direction (1) **allow** all change from + to – (1)
			Total	**2**	

Question			Answer	Marks	Guidance
10			**Level 3** Answers must refer accurately to all the relative distances travelled in each 2 second period. Also the correct accelerations must be given. A good cover of all aspects of the scenario in the question is needed for 5-6 marks. Quality of written communication does not impede communication of the science at this level. **(5–6 marks)** **Level 2** Answers refer to the accurate and relative accelerations for each 2 second period **OR** the correct distances travelled. Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **Level 1** Answers are limited to correct relative accelerations which may be related to the steepness of the gradients. It may not refer to time at all. Quality of written communication impedes communication of the science at this level. **(1–2 marks)** **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted up to grade A*** **Indicative scientific points may include** **Level 3:** • 4m in 1st 2s, 8m then 14m • **and** 2 (m/s^2), then zero acceleration or steady speed, then 3 (m/s^2) **Level 2:** • 4m in 1st 2s, 8m then 14m • **or** 2 (m/s^2), then zero acceleration or steady speed, then 3 (m/s^2) **Level 1:** • correct relative accelerations which may be related to the steepness of the gradients • low acceleration, then no acceleration then higher acceleration Use L1, L2, L3 annotations in scoris; do not use ticks.
			Total	**6**	

Question			Answer	Marks	Guidance
11			weight – 2500 (N) (1) distance – 2(m) (2) but if final answer is incorrect then look for: d = W/F 5000/2500 and award (1)	3	 **allow** 5000 divided by incorrect calculated weight Eg weight = 25N (0) 5000 / 25 scores (1) **but** 5000 / 25 = 200 scores (2) 200m without working scores 0
			Total	**3**	

Question			Answer	Marks	Guidance
12	(a)		0.66 or 0.67 (2) **but** if incorrect: 6/9 or 3/4.5 scores (1)	2	**allow** 0.7 (1) do not allow final answers over 3 or more Decimal place: Eg 0.666 scores (1) **Eg.** 0.6 or 0.6 reoccurring (1)
	(b)		no (no mark to be awarded) 12 (m) (1) doubling speed doubles thinking distance / thinking distance is proportional to speed / AW (1) **OR** from calculation 18 x 0.66 (1)	2	**ignore** no / yes answer **allow** reverse arguments Eg. 9 / 18 = 0.5s which is not the same as the answer to part a because thinking time is constant (2)
	(c)		no (no mark to be awarded)	3	If answer is yes award a maximum of (1) for the idea of KE

Question			Answer	Marks	Guidance
			54 (m) (1) **any two from:** • doubling speed quadruples braking distance / AW (1) • KE or braking distance is proportional to v^2 / AW (1) • KE is absorbed in braking (1)		being absorbed **allow** correct answers derived through calculation
	(d)		**maximum of three marks** Idea of 'the **distance** the car moves' (1) tired / drunk AW / distracted / not concentrating / drugged (1) (The road) is icy / wet / muddy / slippy / downhill **AND** (…. the tyres) have little tread / grip / friction AW (1)	3	 **ignore** old / ill **allow** worn tyres / bald tyres (1)
			Total	**10**	

Question			Answer	Marks	Guidance
13	(a)		**maximum of three marks from:** **more** collision **time** (1) **more** collision **distance** (1) **less acceleration** (1) same quantity of energy absorbed / same change of momentum for each car (1)	3	**allow** ora for an old car longer collision (1) **allow** areas under graph correctly compared (1) **allow** higher level answers in terms of force = change in momentum / time: Eg. force = change in momentum (1) time **but** stating and using the equation can score (3): Eg. force = change in momentum (1) time so a longer collision time (1) means a smaller **rate** of change of momentum (1)
	(b)	(i)	**maximum of two marks from:** experiment with collisions **on a dummy** (under controlled conditions) / model a real **vehicle-pedestrian** collision / AW (1) collect data / measurements / results from this collision (1) draw conclusions from this data (1) change or recommend changes in design / experiment (1)	2	Eg. try dummies of different heights (1) Eg. try crashes at different speeds (1) Eg. make bumpers lower (1)

Question			Answer	Marks	Guidance
		(ii)	(Important so that other scientists can) develop more/improve tests or research (1) (critically) look at their conclusions/findings (1) to see if their research agrees (1) add more data (in time as cars and traffic develop) (1) inform future design (1) inform customer choice (1)	1	**allow** 'check accuracy' (1) Eg. people can choose the safest car (1)
			Total	**6**	

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