Cambridge Assessment

GCSE

Physics A

Session: 2010 June
Type: Mark scheme
Code: J635
Units: A331; A332; A333

OCR
RECOGNISING ACHIEVEMENT

GCSE

Physics A

General Certificate of Secondary Education **A331/01**

Unit 1: Modules P1, P2, P3 (Foundation Tier)

Mark Scheme for June 2010

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Question			Expected Answers	Marks	Additional Guidance
1	a		A C E (1)	[1]	any order
	b		E (1)	[1]	
	c		A (1)	[1]	
	d		C (1)	[1]	**allow** B as ecf, if B given as answer to part **a**
			Total	[4]	

2	a		top – crust (1) middle – core (1) bottom – mantle (1)	[3]	
	b		CAB (1)	[1]	
	c		star (1) galaxy (1)	[2]	
			Total	[6]	

3	a		A (1) C (1) E (1)	[3]	any order
	b		B (1)	[1]	
			Total	[4]	

4	a		emits (1) reflects (1) absorbs (1)	[3]	
	b		infrared (1)	[1]	**allow** IR
			Total	[4]	

5	a		identifies both variables i.e. risk AND area; gives direction e.g. risk *decreases* with area	[2]	one mark for just saying negative correlation 'the more you wear the less chance of getting cancer' scores one only because area not clearly implied
	b		example has two variables (1) correlation between variables explicitly stated (1)	[2]	
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
6			carbon dioxide (1) global warming (1) ultraviolet (1) cancer (1)	[4]	
			Total	[4]	

7	a		Microwaves heat by... ☑ (1) Microwaves are ionising... ☐ The screen on a... ☑ (1) Mobile phones produce... ☑ (1) Microwaves are blocked... ☐ The higher the intensity... ☐	[3]	
	b		...skin from getting hot ☐ ...reflect or absorb... ☑ (1) ...transmit... ☐ ...skin from getting cold ☐	[1]	
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
8	a		government officials (1)	[1]	
	b		benefit – e.g. cures cancer (1) risk – e.g. causes more cancer/protects cancerous cells (1)	[2]	
	c		cells being damaged ☐ cells becoming cancer cells ☐ cells killing themselves ☑ (1) cells becoming radioactive ☐	[1]	
			Total	[4]	

9	a		beta (1) gamma (1) alpha (1)	[3]	
	b		gamma (1)	[1]	**accept** ecf as middle answer in table in part (a)
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
10	a		sensible comparison consistent with choice on efficiency (1) sensible comparison consistent with choice on cost (1) sensible comment consistent with choice on environmental factors (1)	[3]	marks may only be awarded for points based on information from the table.. e.g. coal most efficient (1) relatively cheap (1) and does not produce radioactive waste (1) a sensible comment may be explaining why a feature is less important than another. e.g. wind is not the most efficient, but is still quite efficient.
	b		idea that it is produced/made from another energy source (1)	[1]	**allow** named energy sources or 'primary source'.
			Total	[4]	

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GCSE

Physics A

General Certificate of Secondary Education **A331/02**

Unit 1: Modules P1, P2, P3 (Higher Tier)

Mark Scheme for June 2010

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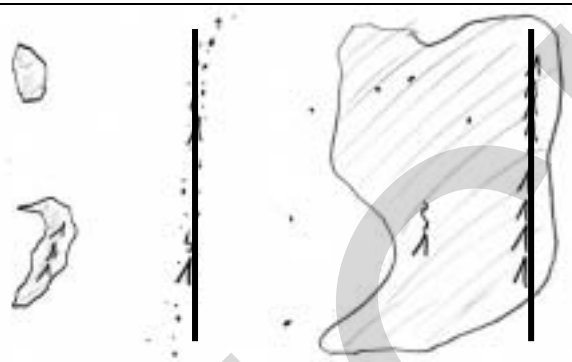
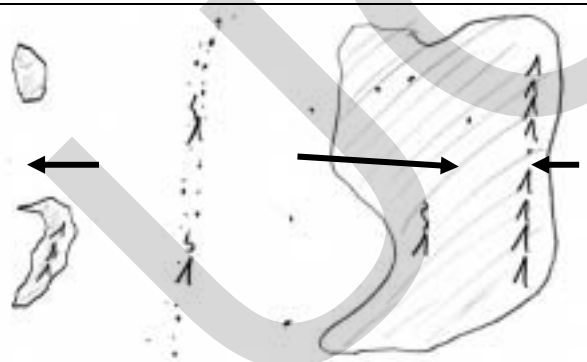
1	a		**A** (1) **C** (1) **E** (1)	**[3]**	any order
	b		**B** (1)	**[1]**	
			Total	**[4]**	

Question			Expected Answers	Marks	Additional Guidance
2	a		distance increases speed increases ☑ (1) distance decrease speed increases ☐ ...inversely related. ☐ Galaxies are moving. ☑ (1) distance increases speed decreases ☐	[2]	
	b		Gravity is acting... ☐ Space is expanding. ☑ (1) Hubble discovered... ☐ ...too many galaxies... ☐	[1]	
	c		Life must exist on other planets ☐ Galaxies are made up of stars. ☐ The universe is orbiting our galaxy ☐ Stars have a life cycle. ☐ The universe started with a 'big bang'. ☑ (1)	[1]	
	d		14 thousand million (1)	[1]	
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
3	a		fossils (1) rock types (1)	[2]	
	b		The theory linked... ☑ (1) Mountains formed... ☐ ...could not be replicated... ☐ The evidence... ☑ (1) ...pattern of magnetism... ☐	[2]	
	c	i		[2]	one mark for identifying rows of mountains as a boundary and one mark for identifying earthquakes as a boundary list principle applies if extra lines drawn
		ii		[1]	any one arrow in the correct direction perpendicular to boundary or horizontal by eye list principle applies

			Total	**[7]**	

Question			**Expected Answers**	**Marks**	**Additional Guidance**
4	**a**		Microwaves heat by... ☑ (1) Microwaves are ionising... ☐ The screen on a... ☑ (1) Mobile phones produce... ☑ (1) Microwaves are blocked... ☐ The higher the intensity... ☐	**[3]**	
	b		...skin from getting hot. ☐ ...reflect or absorb... ☑ (1) ...transmit... ☐ ...skin from getting cold. ☐	**[1]**	
			Total	**[4]**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>5</td><td>a</td><td></td><td>
<table>
<tr><th></th><th>green-house effect</th><th>holes in the ozone layer</th><th>both</th></tr>
<tr><td>skin cancers</td><td></td><td>✓</td><td></td></tr>
<tr><td>electromagnetic radiation</td><td>(✓)</td><td>(✓)</td><td>✓</td></tr>
<tr><td>reversible chemical changes in the atmosphere</td><td></td><td>✓</td><td></td></tr>
</table>
</td><td>[3]</td><td>allow ticks in both greenhouse and ozone layer for ‘electromagnetic radiation’ mark</td></tr>
<tr><td></td><td>b</td><td></td><td>photosynthesis (1)

respiration/respiring (1)</td><td>[2]</td><td>either order
allow phonetic spellings

not breathing/ventilation</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[5]</td><td></td></tr>
</table>

Question			Expected Answers	Marks	Additional Guidance
6			an example of a correlation given – the example must be related to (em) radiation exposure or global warming for this mark (1) the example does not have a causal link (1) correlation explained – e.g. There is a relationship/link between two variables, (But there is not necessarily a causal link between the variables) (1) cause explained – e.g. one variable depends upon another, one variable always follows the other (1)	[4]	if more than one example given apply list principle we are looking for an explanation of the meaning of 'correlation' not a description of their chosen correlation again we are looking for the meaning of 'cause'
			Total	[4]	

7	a		sensible comparison consistent with choice on efficiency; (1) sensible comparison consistent with choice on cost; (1) sensible comment consistent with choice on environmental factors (1)	[3]	marks may only be awarded for points based on information from the table e.g. coal most efficient (1) relatively cheap (1) and does not produce radioactive waste (1) a sensible comment may be explaining why a feature is less important than another e.g. wind is not the most efficient, but is still quite efficient
	b		idea that it is produced/made from another energy source (1)	[1]	**allow** named energy sources or 'primary source'
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
8	a		produces ions / ionising radiation (1) which disrupt chemical reactions / damages DNA (1)	[2]	**ignore** 'ionise cells' and heating effects arguments **accept** causes mutation
	b		(damaged) cells killing themselves (1)	[1]	
	c		government officials (1)	[1]	
			Total	[4]	

9	a	i	3 (1)	[1]	
		ii	4.46 billion years (1)	[1]	must include units **accept** 4.5 billion for 4.46 billion **accept** 4 460 000 000 years **accept** 4.46 x 10^9 years **ecf** if ¼ for part **ai** 53.52 billion years for one mark if 7/8 for part **ai** 15.29 billion years for one mark if 7 for part **ai** 1.91 billion years for one mark if 8 for part **ai** 1.67 billion years for one mark
	b		protons – 90 (1) neutrons – 144 (1) electrons – 0/none (1)	[3]	
			Total	[5]	

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General Certificate of Secondary Education **A332/01**

Unit 2: Modules P4, P5, P6

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   ecf = error carried forward
   AW/owtte = alternative wording
   ORA = or reverse argument

   E.g. 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. Annotations:
   The following annotations are available on SCORIS.

   ✓ = correct response
   ✗ = incorrect response
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   nbod = benefit of the doubt **<u>not</u>** given
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   ^ = information omitted
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   R = reject

6. If a candidate alters his/her response, examiners should accept the alteration.
7. 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.

E.g.
For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	☒
☐	☐	☒
✓	☒	✓
☒	☒	✓
☐	☐	☐
This would be worth 0 marks.	This would be worth one mark.	This would be worth one mark.

8. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

9. Marking method for tick boxes:

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If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.
Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

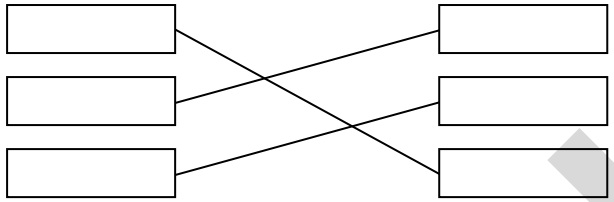
Question			Expected Answers	Marks	Additional Guidance
1	a	i	electrons (1)	[1]	
		ii	positive (1)	[1]	
	b	i	... stay still and do not move. ☐ ... move together and touch. ☐ ... move away from each other. ☑ (1) ... spin around together. ☐	[1]	
		ii	like/same charges (1) repel (1)	[2]	**allow** 2 negative charges/they are both negative/both gain electrons **allow** push away for repel 2 positives repel = one mark
	c		... they have high melting points. ☐ ... free electrons that can move. ☑ (1) ... they conduct heat very well. ☐ ... they are shiny. ☐	[1]	
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	generator (1) electromagnetic (1) alternating (1)	[3]	
		ii	230 (1)	[1]	**not** 240
		iii	transformer (1)	[1]	
		iv	core (1) coil of wire (1)	[2]	core on left coil on right
	b	i	move the magnet/coil (1)	[1]	**accept** annotation of diagram **accept** rotate/spin the magnet
		ii	increase the number of coils ☑ (1) use different coloured wire ☐ use a stronger magnet ☑ (1) use a weaker magnet ☐ use a larger voltmeter ☐	[2]	take off one mark for every extra box ticked
			Total	[10]	

3	a	i	arrow pointing up from the book (1)	[1]	**allow** arrow pointing up towards the book
		ii	15 (1)	[1]	**accept** annotation on diagram
		iii	an interaction (1)	[1]	
	b	i	friction (1) against the book / opposite direction to motion (1)	[2]	
		ii	1.5 x 6 (1) 9 (1)	[2]	
		iii	increases (1)	[1]	**not** faster
			Total	[8]	

Question			Expected Answers	Marks	Additional Guidance
4	a		$\frac{13000}{20}$ (1)	[1]	
	b		**any three from:** burnt fuel / (hot) gases go down / downwards; there is an equal and opposite (thrust) on the rocket; weight/gravitational force/gravity acts down; upwards force/thrust greater than weight/gravity/downwards force;	[3]	owtte idea of interaction pair force pushing rocket up **allow** upthrust
	c		700 000 (1)	[1]	**allow** 700 000 000 Joules / J
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
5	a		matter ☐ energy ☑ (1) disturbances ☑ (1) particles ☐ charge ☐	[2]	
	b		**description** / **type of wave** … same direction … → longitudinal waves … right angles … → transverse waves needs a medium → longitudinal waves … vacuum → transverse waves	[2]	2 or 3 lines correct = one mark 4 marks correct = two marks any two lines from a box on the left, that box is incorrect
	c	i	C (1)	[1]	
		ii	D (1)	[1]	
	d	i	5 oscillations/waves (1) every/per second (1)	[2]	**allow** definition of frequency eg the number of waves in given time for one mark
		ii	50 (1)	[1]	
			Total	[9]	

Question			Expected Answers	Marks	Additional Guidance
6	a		amateur modulation ☐ american modulation ☐ amplitude modulation ☑ (1) analogue modulation ☐	[1]	
	b	i		[2]	1 or 2 lines correct = one mark 3 correct lines = two marks
		ii	idea of extra bits added to the signal (1)	[1]	**do not accept** idea of 'sound' **allow** interference
			Total	[4]	

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☐	☐	☒
✓	☒	✓
☒	☒	✓
☐	☐	☐
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Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

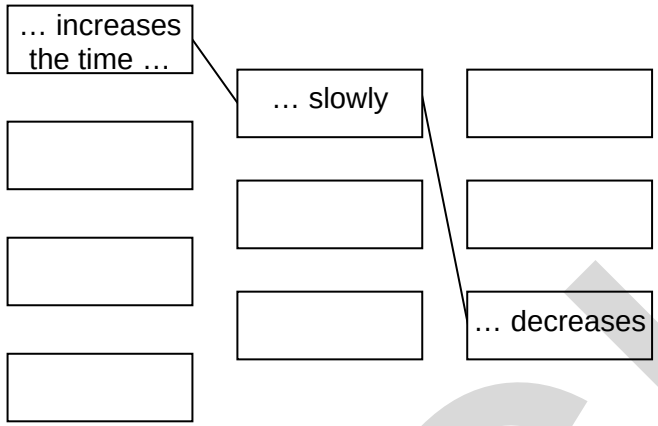
Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

Question			Expected Answers	Marks	Additional Guidance
1	a	i	electrons (1)	[1]	**accept** any clear and unambiguous response
		ii	positive (1)	[1]	**accept** any clear and unambiguous response
	b	i	... stay still and do not move. ☐ ... move together and touch. ☐ ... move away from each other. ☑ (1) ... spin around together. ☐	[1]	
		ii	like/same charges (1) repel (1)	[2]	**allow** 2 negative charges/they are both negative **allow** electrons in place of negative charges **allow** push away for repel 2 positives repel = 1 mark
	c		... they have high melting points. ☐ ... free electrons that can move. ☑ (1) ... they conduct heat very well. ☐ ... they are shiny. ☐	[1]	
			Total	[6]	

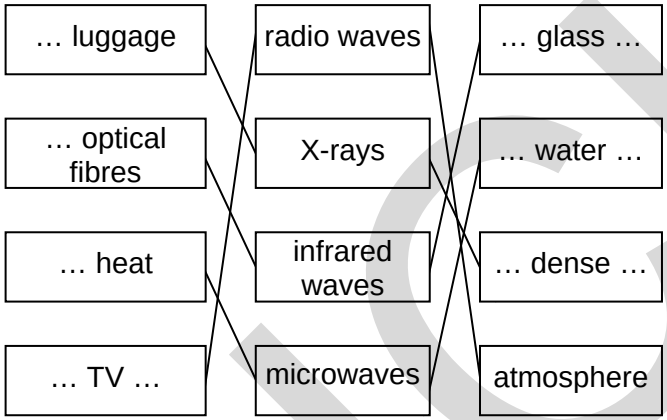
Question			Expected Answers	Marks	Additional Guidance
2	a		magnets move (in relation to coil) (1) leading to a <u>changing</u> magnetic field (1) which causes voltage/potential difference/p.d. to be induced in the coil (1)	[3]	**accept** 'induces current' in place of voltage
	b		transformer (1)	[1]	**ignore** reference to step up/ step down
	c	i	AC/alternating current (1)	[1]	**allow** 'alternating' on its own
		ii	... faster to generate. ☐ ... easier to generate. ✓ (1) ... used in more appliances. ☐ ... less polluting. ☐ ... more efficient to distribute. ✓ (1)	[2]	
			Total	[7]	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	unit conversion 450g = 0.45kg (1) 90 (1)	[2]	**allow** answer of 90 000 for 1 mark correct numerical answer gains both marks
		ii	90 (J) (1)	[1]	**allow** the same numerical answer as part (a) (i) above for 1 mark
	b		idea of equal and opposite force (1) force <u>on</u> the foot/football boot/Ian <u>from</u> the ball (1)	[2]	
	c			[2]	award 1 mark if the line on the left starts from the top box (regardless of which box in the middle it is joined to) if more than one box selected in left column, the mark for that link will be zero award 1 mark if top box in the middle is linked to the bottom box on the right if more than one box selected in middle and/or right column, the mark for that link will be zero
			Total	[7]	

Question			Expected Answers	Marks	Additional Guidance
4	a		**any three from:** burnt fuel / (hot) gases go down / downwards; there is an equal and opposite (thrust) on the rocket; weight/gravitational force/gravity acts down; upwards force/thrust greater than weight/gravity/downwards force;	[3]	owtte idea of interaction pair force pushing rocket up **allow** upthrust
	b		700 000 (kJ) (1)	[1]	**allow** 700 000 000 J
	c		$\frac{13\ 000\ 000\ 000}{1000}$ (1) $13\ 000\ 000 / 1.3 \times 10^7$ (1)	[2]	full marks for correct answer with no/unclear working **allow** 1 mark for correctly rearranged word formula in place of first marking point answer does not need to be in standard form **allow** correct answers in kN etc provided they are clearly presented
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
5	a		matter ☐ energy ☑ (1) disturbances ☑ (1) particles ☐ charge ☐	[2]	
	b		**description** / **type of wave** … same direction … → longitudinal waves … right angles … → transverse waves needs a medium → longitudinal waves … vacuum → transverse waves	[2]	2 or 3 lines correct = one mark 4 marks correct = two marks any two lines from a box on the left, that box is incorrect
	c	i	vertical line from central line to peak (top of wave) or trough (bottom of wave) (1)	[1]	**allow** approximately 1mm tolerance in drawing **accept** a correctly drawn line with the label 'A' missing
		ii	C (1)	[1]	**accept** E for 1 mark
	d	i	stopwatch (1)	[1]	**accept** any clear and unambiguous response
		ii	$\frac{\text{number of waves}}{\text{time}}$ (1)	[1]	**accept** any clear and unambiguous response
			Total	[8]	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>6</td><td>a</td><td>i</td><td>300 000 km/s (1)</td><td>[1]</td><td>accept any clear and unambiguous response.</td></tr>
<tr><td></td><td></td><td>ii</td><td>
<table>
<tr><th>property of wave</th><th>sound</th><th>light</th><th>both</th></tr>
<tr><td>can travel though a vacuum</td><td></td><td>✓</td><td></td></tr>
<tr><td>needs a solid, liquid or gas to travel through</td><td>✓</td><td></td><td></td></tr>
<tr><td>can show interference</td><td></td><td></td><td>✓</td></tr>
<tr><td>can show diffraction</td><td></td><td></td><td>✓</td></tr>
</table>
</td><td>[3]</td><td>for rows 3 and 4 only, allow ticks in ‘sound’ and ‘light’ columns as equivalent to a single tick in the ‘both’ column

four rows correct = 3 marks
three rows correct = 2 marks
two rows correct = 1 mark</td></tr>
<tr><td></td><td>b</td><td></td><td> 
</td><td>[4]</td><td>mark left and right hand side separately

for each side:
four correct links = 2 marks
two or three correct links= 1 mark

more than one link from a box = incorrect link for that box</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[8]</td><td></td></tr>
</table>

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GCSE

Physics A

General Certificate of Secondary Education **A333/01**

Unit 3: Ideas in Context plus P7

Mark Scheme for June 2010

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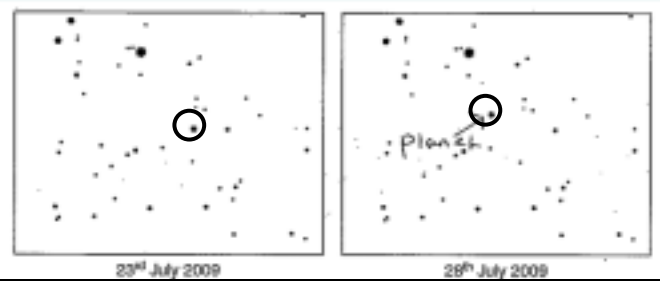
E-mail: publications@ocr.org.uk

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>absorbs (1)
more (1)
damages (1)</td><td>[3]</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td><table><tr><td></td><td>gases</td><td>effect</td></tr><tr><td>ozone</td><td></td><td></td></tr><tr><td>greenhouse</td><td>carbon dioxide (1)</td><td>global warming/climate change (1)</td></tr></table></td><td>[2]</td><td>allow methane instead of CO_2</td></tr>
<tr><td></td><td>c</td><td>i</td><td>volcanic eruptions (1)</td><td>[1]</td><td>accept example of earthquake eruption. Eg Mt Pinatubo</td></tr>
<tr><td></td><td></td><td>ii</td><td>names two variables (1)
correct direction of link (1)
e.g. increased sulfate particles and decreased ozone</td><td>[2]</td><td>other examples are:
more sulfate particles leads to slower repair of ozone hole
more sulfate particles leads to greater surface area for reactions
more sulfate particles reflects more sun light
more volcanic eruptions decrease ozone levels
more volcanic eruptions decrease planet temperature.</td></tr>
<tr><td></td><td>d</td><td></td><td>any two from:
food crops not growing;
extreme weather conditions / a named example;
rising sea levels/flooding low lying land (due to rising sea levels);</td><td>[2]</td><td>not thinning of ozone layer
not “global warming” on its own
allow destroy habitats leading to extinction.</td></tr>
<tr><td></td><td>e</td><td>i</td><td>risk - idea of more uv radiation/ozone destruction (1)

benefit - reduced global warming/less climate change/sunlight reflected(1)

situation – when climate change is becoming catastrophic/specific example e.g. severe global flooding (1)</td><td>[3]</td><td>ignore ‘planet becomes too cool’

ignore ‘cools the planet’ or reference to temperature
accept specific examples of the benefits of reduced global warming e.g. reduces sea level rising</td></tr>
<tr><td></td><td></td><td>ii</td><td>physical barrier to uv e.g. sun-screen, clothing / keep out of sun/in shade (1)</td><td>[1]</td><td>reject general remarks such as ‘protect from sun’
allow ‘put on sun protection’ (this assumes sun protection is some form of cream)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[14]</td><td></td></tr>
</table>

Question			Expected Answers	Marks	Additional Guidance
2	a	i	correctly labelled planet (1)  	[1]	
		ii	move differently from (fixed) stars / retrograde/complex motion (1)	[1]	**allow** 'move more' comparison with (fixed) stars is required, not just 'it moves'
	b	i	Earth rotates/spins / stars move across the sky / around the pole star / the camera is open for along time so the stars move (1)	[1]	'Earth moves' is insufficient
		ii	6 (1)	[1]	
	c		Idea of Earth on opposite sides of its orbit (1) facing different directions/looking at different part of the sky (1)	[1] [1]	both marks can be gained from diagram **allow** 1 mark only for observer has moved to other side of earth argument
	d		**any two from:** idea that the Earth orbits the sun (in the same sense as the Earth's spin) (1) idea of earth has to rotate more (than 360^{o}) (1) idea that the Sun returns to the same position (in the sky) (1)	[2]	
	e		idea of angle (1) additional detail of how to use the angle e.g. across and up / azimuth is angle from North (1)	[1] [1]	**accept** declination measured from equator **or** right ascension measured from the vernal equinox **ignore** coordinates latitude and longitude are insufficient on their own
	f	i	**C** (1)	[1]	

Question			Expected Answers	Marks	Additional Guidance
2	f	ii	**any two from:** benefit of remote control; Idea of greater precision; tracking of stars / idea of used over a long period of time (astronomical objects);	[2]	 e.g. she doesn't have to be outside/she can do something else/saves time **reject** ideas about image processing or sharing data **allow** greater accuracy/finding stars more easily **ignore** human error
			Total	[13]	

3			includes Earth, Moon and Sun in explanation (1) Moon in between Earth and Sun (1) Moon blocks light from Sun/casts shadow (1)	[3]	all marking points may be shown on a diagram
			Total	[3]	

4	a	i	W (1)	[1]	
		ii	1/0.8 (1) 1.25 (1) D or Dioptre (1)	[3]	2 marks for correct numerical answer
		iii	...largest diameter. ☑ (1) ...longest focal length. ☐ ...the most powerful. ☐ ...collect the most light. ☑ (1)	[2]	
	b		2 (1)	[1]	
	c		(concave) mirror (1)	[1]	**ignore** reflector
			Total	[8]	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	luminosity (1) peak frequency of light (1)	[2]	
		ii	6973(.15) (1)	[1]	
	b	i	A (1) C (1)	[2]	
		ii	electrons (1) line (1)	[2]	
			Total	[7]	

6	a		...small positive centre. ☑ (1) ...smallest possible particles. ☐ ... large positive charges ☐ ... large negative charge ☐	[1]	
	b	i	reflection ☐ nuclear fusion ☑ (1) combustion ☐ nuclear fission ☐	[1]	
		ii	inside Sun: radiation (1) convection (1) Sun to Earth: radiation (1) QWC – two ideas, clear expression/ distinction between internal and external transfers (1)	[3] [1]	**allow** heat waves or rays for one mark only
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
7	a		1000000 / 1 million / 10^6 (1)	[1]	**reject** mega!
	b	i	B / Cepheid (variables stars) (1)	[1]	
		ii	200 x 70 (1) 14000 (1)	[2]	award 2 marks for correct numerical answer of 14000
			Total	[4]	

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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, e.g. 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

   E.g. 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. Annotations:
   The following annotations are available on SCORIS.

   ✓ = correct response
   ✗ = incorrect response
   bod = benefit of the doubt
   nbod = benefit of the doubt **<u>not</u>** given
   ECF = error carried forward
   ^ = information omitted
   I = ignore
   R = reject

6. If a candidate alters his/her response, examiners should accept the alteration.
7. 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.

E.g.
For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	✓
☐	☐	✓
✓	✓	☐
✓	✓	☐
☐	☐	☐
This would be worth 0 marks.	This would be worth one mark.	This would be worth one mark.

8. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

9. Marking method for tick boxes:

Always check the additional guidance.

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.
Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

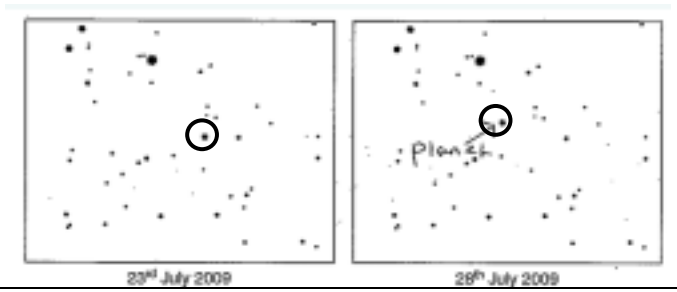
Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**NR**

Question			Expected Answers	Marks	Additional Guidance
1	a	i	risk - idea of more uv radiation/ozone destruction (1) benefit - reduced global warming/less climate change/sunlight reflected(1) situation – when climate change is becoming catastrophic/specific example e.g. severe global flooding (1)	[3]	**ignore** 'planet becomes too cool' **ignore** 'cools the planet' or reference to temperature **accept** specific examples of the benefits of reduced global warming e.g. reduces sea level rising
		ii	physical barrier to uv e.g. sun-screen, clothing / keep out of sun/in shade (1)	[1]	**reject** general remarks such as 'protect from sun' or 'reduce exposure to sunlight' **allow** 'put on sun protection' (this assumes sun protection is some form of cream)
	b	i	evidence – volcanic eruptions (1) reason – very limited evidence/only one example/coincidence/just by chance (1) QoWC clear and ordered answer (1)	[2 + 1]	**accept** evidence as use of computer simulations or modelling **allow** 'scientists suggest more research is needed' **ignore** suggestion of other factors if the candidate's response makes sense on the first reading, and has addressed the question, they get the mark
		ii	sulfate particles <u>reflect</u> some sunlight/radiation (1) reduced energy/heat into atmosphere/surface (1)	[2]	**reject** 'block the sunlight' or 'absorb' **ignore** reduces temperature/less warming **allow** 'reflects energy' for 2nd marking point but not the 1st
		iii	**any two from:** idea of cause / causal link; plausible explanation supports argument; provides (additional) evidence;	[2]	 **accept** idea of provides a mechanism/shows how it works 'Theory' is insufficient

Question			Expected Answers	Marks	Additional Guidance
1	c		**any two greenhouse effect points from:**	[4]	any 2 marks for greenhouse effect
			carbon dioxide/methane/water vapour;		**reject** non greenhouse gases **allow** nitrous oxide/nitrogen oxide **ignore** etc.
			prevents (some) radiation escaping (from Earth);		
			global warming/climate change/specific examples e.g. polar ice caps melting;		**allow** temperature rise
			plus		
			any two ozone layer points from:		any 2 marks for ozone layer
			Ozone/O_3;		**accept** CFCs
			(Ozone layer) reduces ultraviolet/hole lets more through;		
			ionising radiation/harmful effects to living organisms;		
			Total	[15]	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	correctly labelled planet (1)  	[1]	
		ii	move differently from (fixed) stars / retrograde/complex motion (1)	[1]	**allow** 'move more' comparison with (fixed) stars is required, not just 'it moves'
	b	i	Earth rotates/spins / stars move across the sky / around the pole star / the camera is open for along time so the stars move (1)	[1]	'Earth moves' is insufficient
		ii	6 (1)	[1]	
	c		Idea of Earth on opposite sides of its orbit; facing different directions/looking at different part of the sky;	[1] [1]	both marks can be gained from diagram **allow** 1 mark only for observer has moved to other side of earth argument
	d		**any two from:** idea that the Earth orbits the sun (in the same sense as the Earth's spin) (1) idea of earth has to rotate more (than 360^{o}) (1) Idea that the Sun returns to the same position (in the sky) (1)	[2]	
	e		idea of angle (1) additional detail of how to use the angle e.g. across and up / azimuth is angle from North (1)	[1] [1]	**accept** declination measured from equator **or** right ascension measured from the vernal equinox **ignore** coordinates latitude and longitude are insufficient on their own
	f	i	**C** (1)	[1]	

Question			Expected Answers	Marks	Additional Guidance
2	f	ii	**any two from:**	[2]	
			benefit of remote control;		e.g. she doesn't have to be outside/she can do something else/saves time **reject** ideas about processing images/sharing data
			Idea of greater precision;		**allow** greater accuracy/finding stars more easily **ignore** human error
			tracking of stars / idea of used over a long period of time (astronomical objects);		
			Total	[13]	

3	a		**C** (1)	[1]	**accept** 0.75 as a unique identifier from table
	b	i	0.05 (1) m (1)	[2]	**accept** 5 cm for 2 marks
		ii	**W** (1)	[1]	**accept** 4 or 20 as unique identifiers from table
		iii		[3]	Independent marking points
			Y (1)		**accept** 10 or 0.67 as unique identifiers from table
			largest (1)		**accept** large diameter or bigger aperture
			need to collect as much light as possible (1)		**ignore** diffraction effects
	c		concave/converging mirror (1)	[1]	
			Total	[8]	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	increased temperature, increased luminosity (1)	[1]	**allow** positive correlation **reject** proportional
		ii	Increasing temperature gives decreasing (peak) wavelength (1)	[1]	more smaller wavelengths with increasing temperature
		iii	6973(.15) (1)	[1]	
	b		**A** (1) **C** (1)	[2]	list principle applies
			Total	[5]	

5	a		idea of gravity (1) volume of cloud decreases / collapse / condenses / increased cloud density (1) Idea of a pressure increase (1)	[3]	**accept** particle explanations for each marking point e.g. 'gravity brings about an increase in the kinetic energy of particles hence more collisions between them' gains 3 marks **ignore** fusion
	b		(nuclear) fusion (1)	[1]	
			Total	[4]	

6	a	i	a speed ÷ a distance (1) 500 (±50) (1)	[2]	correct numerical answer (500 ± 50) gains 2 marks
		ii	750 ÷ 71 (1) 10 .6 or (10.56338) (1) Mpc/megaparsec (1)	[2] [1]	correct numerical answer gains 2 marks **accept** 11 for 2 marks
	b	i	A Cepheid's brightness varies (1) period luminosity relationship (1) idea of comparing luminosity/period and apparent brightness (1)	[3]	must be explicit **allow** rate of 'pulses' linked to luminosity **accept** ' (intrinsic) brightness' for luminosity
		ii	parallax (1) idea of colour/brightness/luminosity linked to distance (1)	[2]	 **accept** using apparent brightness and luminosity
			Total	[10]	

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