OCR
Oxford Cambridge and RSA

GCSE

Physics A

Unit **A181/02:** Unit 1 – Modules P1, P2, P3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2015

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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.

Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	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
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	alternative wording
ORA	or reverse argument

Available in scoris to annotate scripts

	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	no benefit of doubt
	reject

	correct response
	draw attention to particular part of candidate's response
	information omitted

Subject-specific Marking Instructions

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

b. 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 1 mark.	This would be worth 0 marks.	This would be worth 1 mark.

c. 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.

d. 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**

MARK SCHEME: overlap with A181/01 shown by shading in column 3

Question			Answer	Mark	Guidance
1			**(Level 3)** Good sketch of central star with at least five planets in separate orbits **and** at least two relevant statements about formation. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** **EITHER** Good sketch of central star with at least five planets in separate orbits **or** at least two relevant statements about formation **OR** Sketches a star with one orbiting planet **and** relevant statement about formation. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Sketches a star with one orbiting planet **or** relevant statement about formation. 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 at grades up to C** **Indicative scientific points may include:** **Sketch/description of τ Ceti system** • central star/sun and planets (ignore any names) clearly distinguished e.g. by labelling or relative sizes • (at least) five planets: need not be in same plane • planetary orbits indicated/described • Star at centre of orbits • Ignore dust **description of formation** • started with cloud of dust and gas • gas condensed/came together (by gravity) • most in middle • middle bit formed the star • nuclear fusion takes place in star • other bits formed planets • may also refer to asteroids or comet. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>2</td><td>a</td><td>i</td><td>time = ((8×60)+ 20)×60 = 30 000 (s) (1);
distance = 180 m/s × 30 000 s= 5 400 000 (m) (1);
= 5400 (km) (1)</td><td>3</td><td>bald correct answer 5400 gets all 3 marks
omitting min to s gives 500
ecf own time
mark for (correctly) dividing own distance/m by 1000
1 error (e.g. min/s or km/m) would give 90 km or 5 400 000 km and either would get 2 marks; both factors wrong gives 90 000 km which is one mark (for method)</td></tr>
<tr><td></td><td>a</td><td>ii</td><td>Reason: must be between 2000 m and 4000 m</td><td>1</td><td>no mark for the value (although it may indicate that the method is reasonable); give a mark for the reasoning.</td></tr>
<tr><td></td><td>b</td><td></td><td>If you divide the speed by the depth (or vice versa) you get the same value/ you plot a graph, it’s a straight line though the origin / speed = constant x depth (1);
use of data to show that it is not true (1)</td><td>2</td><td>Proposing a test (which includes attempting to perform it) e.g. dividing one variable by the other, or sketching a graph, gets the first mark
Second mark needs application of the test (which could be an annotated sketch graph or 45/10 is not 200/10)</td></tr>
<tr><td></td><td>c</td><td></td><td>The amplitude is bigger on the shore/ smaller in mid-ocean (1);
Wavelength gets smaller/waves bunch more/waves slow down as they approach land (1);
Large amplitude means more (potential) energy (to cause damage) (1);
Waves go further inland/can get over barriers (1)</td><td>2</td><td>any two points
large amplitude could be ‘taller/higher wave’ but ignore ‘bigger waves’; could describe vertical motion of e.g. ship
ignore “frequency change”

ignore kinetic energy

e.g. can cause flooding inland</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
<tr><td>3</td><td>a</td><td></td><td><table><tr><th></th><th>Supports W</th><th>Contradicts W</th><th>Neither</th></tr><tr><td>fossils</td><td>✓</td><td></td><td></td></tr><tr><td>humans</td><td></td><td></td><td>✓</td></tr><tr><td>rocks</td><td></td><td></td><td>✓</td></tr><tr><td>Atlantic width</td><td></td><td>✓</td><td></td></tr></table></td><td>3</td><td>All correct = (3);
Three rows correct = (2);
Two rows correct = (1)</td></tr>
<tr><td></td><td>b</td><td></td><td>2nd & 4th boxes (magnetism changes & seafloor spreads)</td><td>1</td><td>BOTH needed for the mark (unlike 5ai and 5aii)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
<tr><td>4</td><td>a</td><td></td><td>H</td><td>1</td><td>and no others</td></tr>
<tr><td></td><td>b</td><td></td><td>C, O, Fe</td><td>1</td><td>all three and no others (in any order)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>a</td><td>i</td><td>Alice (1);
Chandra (1)</td><td>2</td><td>One mark for each (unlike 3b)
If 3 ticks, deduct 1 ; if 4 or more ticks, no marks</td></tr>
<tr><td></td><td>a</td><td>ii</td><td>Ben (1);
Eddie (1)</td><td>2</td><td>One mark for each (unlike 3b)
If 3 ticks, deduct 1 ; if 4 or more ticks, no marks</td></tr>
<tr><td></td><td>b</td><td></td><td>
<table>
<tr><th>change</th><th></th><th>explanation</th><th></th></tr>
<tr><td>Habitat change/ desertification/ crops may not grow in some regions /species may become extinct</td><td>(1);</td><td>due to too hot/cold/dry/wet</td><td rowspan="3">(1)</td></tr>
<tr><td>more extreme weather events/ drought</td><td>(1);</td><td>because of increased convection/more water in atmosphere/more energy in atmosphere or ocean/changes to ocean and atmospheric currents</td></tr>
<tr><td>Species move in to new areas, e.g. mosquitos (malaria spreading northwards)</td><td>(1);</td><td>Previously unsuitable habitats become suitable e.g warmer</td></tr>
</table>
</td><td>3</td><td>two marks for suggested changes and one for an appropriate explanation of either change.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>7</td><td></td></tr>
<tr><td>6</td><td>a</td><td></td><td>Noise/interference is less of a problem/signal quality is better / noise can be removed (1);
can be stored in computers (1);
can be processed by computers (1)</td><td>2</td><td>any two
accept ‘less affected by noise’, ‘clearer’;
ignore ‘do not pick up noise’, ‘stronger/better signal’

accept ‘more information per second’ or ‘more channels’ as a separate marking point</td></tr>
<tr><td></td><td>b</td><td></td><td>
<table>
<tr><th></th><th>atmos</th><th>opt fibre</th></tr>
<tr><td>microwaves</td><td>✓</td><td></td></tr>
<tr><td>not much absorbed</td><td>✓</td><td>✓</td></tr>
<tr><td>photons</td><td>✓</td><td>✓</td></tr>
<tr><td>speed</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>2</td><td>all correct = (2);
three rows correct = (1)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
7			**(Level 3)** Explains a benefit and explains a risk. Recognises that mobile phones emit microwaves which are not ionising but absorbed by water in the body. Reasons for greater risk to children are given. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Explains a benefit and explains a risk. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Explains a benefit or explains a risk. Explanation of risk may be superficial, e.g. 'May give you brain cancer'. 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 at grades up to A*** **Indicative scientific points related to consideration of risk may include:** • mobile phones used close to head • could damage/'cook' brain • as brain is mostly water, which absorbs microwaves • younger people more at risk than older people • due to developing brains • and thin skulls • and they use mobile phones very frequently • mobile phones have not been around for long enough to be certain they are safe • hazard of online grooming/ cyberbullying • Cause driving accidents/walking into traffic/etc. • Not ionising radiation, so risk is low • Perception of risk may be high **Indicative scientific points related to benefits may include:** • can contact home in emergencies • allows parents to contact children easily • allows communication with friends/family • will not be social outcast • education advantage of access to knowledge At L1 & L2, accept explanations of risk in terms of general properties of radiation or of non-scientific factors. At L3 risk needs to be correct science and related to microwave radiation/low photon energy. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Mark	Guidance
8			Incident power = 0.9 × 35 000 × 1.2 m^2 = 37 800 (kW) (1); electrical output = 37 800 W × (15/100) = 5670 (kW) (1); = 5.670 MW (< 7.5 MW) (1);	3	(total Power) (efficiency) (conversion kW to MW) Bald answer 5.7 MW would get all 3 marks **Apply ecf throughout this question**
			Total	**3**	
9	a		3	1	
	b		300 000	1	
	c		7 minutes	1	
			Total	**3**	
10	a		2nd box (stronger magnet, faster spin)	1	
	b		turbine generator transformer Turbine followed immediately by generator (1); generator followed immediately by transformer (1)	2	If turbine…… XXXX…… transformer, allow 1 mark e.g. 'pipe turbine generator' gets m.p.1
	c		Output from plant = 2.25 × 10^{10} W – 1.0 × 10^8 W = 2.24 × 10^{10} (W) (1); %age of China's needs= 100 %×2.24×10^{10} W / 3.2×10^{12} W = 0.7 (%) (1)	2	Allow ignoring 1.0 × 10^8 W if justified/output = 2.25 × 10^{10} W because 1.0 ×10^8 W is negligible compared with 2.25×10^{10} W which gives the answer %age of China's needs= 100 %×2.25×10^{10} W / 3.2×10^{12} W = 0.703 (%) = 0.7% **ecf own output for the 2nd mark**
			Total	**5**	

Question			Answer	Mark	Guidance
11			**(Level 3)** Analyses each site in terms of advantages and disadvantages, with quantitative use of data from graph and bar chart. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Makes qualitative use of bar chart combined with efficiency graph to compare site feasibility with reference to distance from site to consumers. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Makes simple comparison of wind speed differences or locations for all three sites. 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 at grades up to A*** **Indicative scientific points related to wind speed may include:** • need speeds in range > 5 m/s to work • bar chart shows averages, so can be 0 or can be very large • winter speeds greater than summer • winter energy requirements greater than summer • Paisley has speeds too low to generate any electricity • Kinloss just about OK • Kirkwall the best provider **Indicative scientific points related to situation may include:** • Paisley close to users • Kinloss not too far from a city (Aberdeen) • Kirkwall very distant • Kirkwall not on mainland (so undersea cables needed) • But infrastructure may be already in place • Maintenance is harder for more remote locations • half of all Scots don't live in the three cities (and are presumably spread around Scotland) At L1, candidate will probably not combine data; at L2 candidates will combine graph and bar chart but in a descriptive way; at L3, data are used quantitatively (combining wind speed & efficiency) to compare sites. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**6**	

Question			Answer	Mark	Guidance
12	a		**generic hazards:** ionising radiation emitted by radioactive materials (1); and can cause cellular damage/mutation/cancer (1); **coal-burning power station:** emits (lots of) CO_2 (a major greenhouse gas) (1); emits lots of /nearly 10× as much radioactive waste (as nuclear power station) (1); fly ash can be breathed causing radioactive contamination(1); fly ash would be spread into environment (by wind) (1); filters / screens are used to remove nearly all fly ash (1); **nuclear power station:** idea of controlled disposal needed for nuclear waste (1); nuclear waste is more concentrated/long lasting than fly ash (credit correct P6 discussion here) (1)	**3**	Any three points. ORA: nuclear doesn't emit CO_2 ORA: nuclear produces less radioactive waste N.B. All Physics candidates will also have done Unit 6, but Science candidates will not, and so will not have studied the different sorts of radioactive waste. These can be credited but should not be required.
	b		Typical approach For each PS, 1 day ⇒ 24 h× 1200 MW = 28 800 (MWh) (1); **And then either:** mass CO_2 produced by coal-burning PS = 28 800 × 550 kg = 15 840 000 kg / 1.584 × 10^7 kg (1); mass CO_2 produced by gas-burning PS = 28 800 × 180 kg = 5 184 000 kg / 5.184 × 10^6 kg so reduction = 10 656 000 kg / 1.07× 10^7 kg (1) **or:** Mass difference per MWh = 550-180 = 370 kg (1); Mass difference per day = 370x28800 kg =10 656 000 / 1.07× 10^7 kg (1)	**3**	Valid alternative approaches should be credited (Look for 2 multiplications and a subtraction in any order) bald correct answer 10 656 000 kg / 1.07× 10^7 kg gets all 3 marks. Two common wrong answers bald answer of 444 000 kg/ 440 000 kg/ 4.4× 10^5 kg gets 2 marks (omits multiplying by 24 hours) bald answer of 8880 kg/ 8900 kg gets 2 marks (omits multiplying by 1200 MW) **ecf throughout** If 24 h not used, energy = 1200 MWh Mass from coal = 660 000 kg mass from gas = 216 000 kg reduction = 444 000 kg Can get this mark for gas-burning PS if done first If gas done first, this mark is mass from coal + subtraction **Units needed in final answer**
			Total	**6**	

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