Markscheme

May 2019

Physics

On-screen examination

13 pages

The following are the annotations available to use when marking responses.

Annotation	Explanation
	Correct point, place at the point in the response where it is clear that the candidate deserves the mark. For use in analytically marked questions only.
	Omission, incomplete
CON	Contradiction
	Valid part (to be used when more than one element is required to gain the mark)
	Error carried forward
	Dynamic annotation, it can be expanded to surround work
	Horizontal wavy line that can be expanded
	Highlight tool that can be expanded to mark an area of a response

Annotation	Explanation
	Not good enough
	The candidate has given a response but it is not worthy of any marks
	Test box used for additional marking comments
	Seen; must be stamped on all blank response areas and on duplicate pages of concatenated responses
	Vertical wavy line that can be expanded
	Words to that effect
	Award 1, 2, 3, 4 marks. For use in holistically marked questions only

Markscheme instructions

1 Mark positively. Give candidates credit for what they have achieved and what is correct. Do not deduct marks for incorrect responses.

2 Follow the markscheme provided and award only whole marks.

3 Each marking point appears on a separate line.

4 The maximum mark for each subpart is indicated in the "Total" column.

5 Where a mark is awarded a tick should be placed in the text at the precise point where it is clear the candidate deserves the mark.

6 Each marking point in a question part should be awarded separately unless there is an instruction to the contrary in the Notes column.

7 A question subpart may have more marking points than the total allows. This will be indicated by the word "***max***" in the Answer column. Further guidance may be given in the Notes column.

8 Additional instructions on how to interpret the markscheme are in bold italic text in the Answer column.

9 Alternative wording may be indicated in the Answer column by a slash (/). Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.

10 Alternative answers are indicated in the Answer column by "***or***". Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.

11 If two related points are required to award a mark, this is indicated by "***and***" in the answer column.

12 Words in brackets ( ) in the Answer column are not necessary to gain the mark.

13 Words that are <u>underlined</u> are essential for the mark.

14 In some questions a reverse argument is also acceptable. This is indicated by the abbreviation *ORA (or reverse argument)* in the Notes column. Candidates should not be rewarded for reverse arguments unless *ORA* is given in the Notes column.

15 If the candidate's response has the same meaning or is clearly equivalent to the expected answer the mark should be awarded. In some questions this is emphasized by the abbreviation *WTTE (or words to that effect)* in the Notes column.

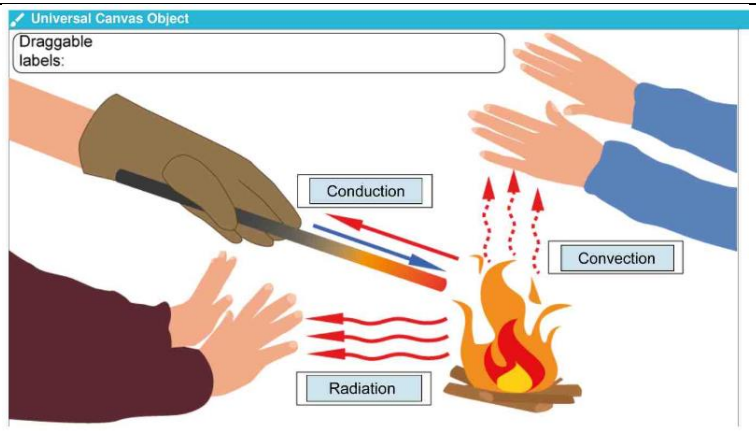
16 When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add ECF (error carried forward) to the candidate response.

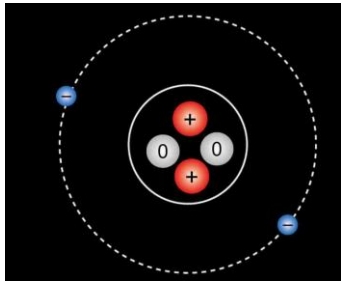
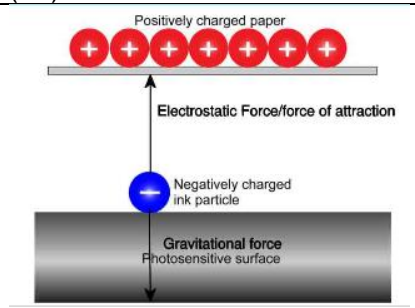
17 The order of marking points does not have to be the same as in the Answer column unless stated otherwise.

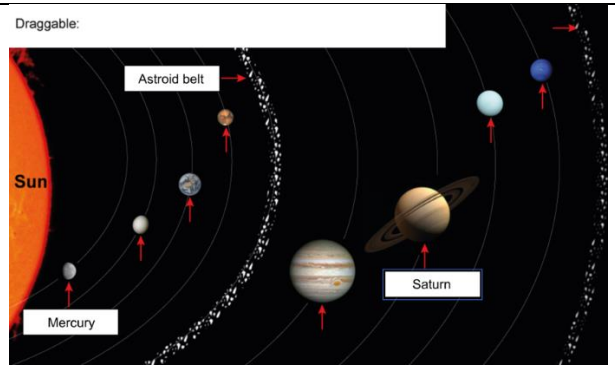
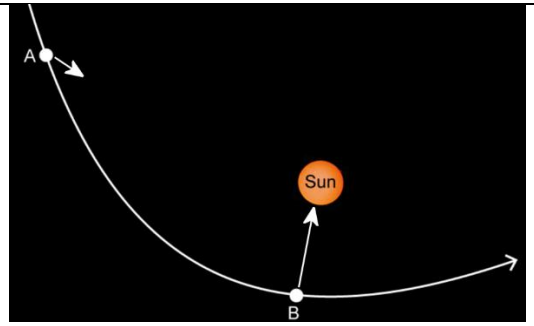
18 Marks should not be awarded where there is a contradiction in an answer. Add CON to the candidate response at the point where the contradiction is made.

19 Do not penalize candidates for errors in units or significant figures unless there is specific guidance in the Notes column.

20 Questions with higher mark allocations will generally be assessed using a level response method using task specific clarifications developed with reference to the criteria level descriptors. A candidate's work should be reviewed to determine holistically the mark for each row of the holistic grid and a mark awarded for each row.

Question		Answers	Notes	Total	Criterion
1	a	 All correct		1	A
	b	Celsius/(°)C ***or*** Kelvin/K Joules/J ***or*** kilojoules/kJ		2	A
	c	***Feature of Dewar flask and named type of heat transfer [2 max]*** ***correctly linked scientific explanation [2 max]*** • silvered surface reflects (infra red) <u>radiation</u> • so the sun's rays are reflected away from the ice • vacuum prevents <u>conduction</u> • because conduction needs a medium and there is no medium for heat / (thermal) energy to transfer (from the surroundings) to the ice • insulated support prevents <u>conduction</u> • heat / (thermal) energy cannot transfer through insulating materials and (so) cannot transfer (from the surroundings) to the ice	*Do **not** accept reference to the stopper* *Accept references to moving particles*	4	A

2	**a**	 All correct	*Accept overlapping protons and neutrons*	**1**	A
	b	Electrostatic force		**1**	A
	c	Positives and negative charges <u>attract</u> ***or*** there is an <u>attractive</u> force (So) the ink sticks ***or*** is attracted to the paper to create the copy	*Ignore references to magnetism*	**2**	A
	d	 single arrow pointing up at 90° to the photosensitive surface single arrow pointing down at 90° to the photosensitive surface labels: electrostatic (force) ***or*** gravitational force	*Ignore relative size of arrows* *Arrows must touch or be very close to touching the surface of the particle (judge by eye)* *Additional arrows are CON* *Award separately* *Accept weight or gravity*	**3**	A
	e	Force ***or*** attraction increases as the distance between charges ***or*** the oppositely charged surfaces decreases Distance needs to be small so the electric force can be greater than any opposing ***or*** downward force or weight Ink will then stick to the paper	*Accept reference to attractive force from positive drum surface*	**3**	A

3	**a**	 Two correct – one mark All three correct – two marks		**2**	A
	b	Distance ***or*** mass		**1**	A
	c	 One arrow pointing towards the Sun Both arrows point in the direction of the Sun Arrow at A shorter than arrow at B	*Judge by eye*	**3**	A
	d	evidence of use of the correct equation 562 000 000 (kg) ***or*** 5.62 x 10^8 (kg)	*Seen or implied* *Award two marks for the correct answer.*	**2**	A
	e	Selection of correct equation 56 200 000 (N) ***or*** 5.62 x 10^7 (N)	*Seen or implied* *ECF from part d*	**2**	A

4	**a**	100 kmh^{-1}	*Accept km/h. Do **not** accept kmh^-1or unit written out as words*	**2**	C
	b	Only weight identified as the IV Only air speed identified as the DV Only CSA ***and*** shape identified as the CV		**3**	B
	c	As the weight increases, the air speed needed increases Reference to air speed^2 ***Correct scientific information, for example [1 max]:*** • reference to Newton's first law • description of forces in equilibrium (weight and drag)	*Accept reference to gravitational force, do **not** accept gravity*	**3**	B
	d	All balls have the same CSA Balls with weight 1.20 N and 0.40 N are chosen Only 5 balls chosen	*No ECF from part b* *Award the third mark only if the first two marks are awarded*	**3**	B
	e	***Any two points from the following list [2 max]**:* • greatest possible range • this will generate sufficient data • control variables held constant		**2**	B
	f	Number of trials between 3 and 5 ***Any reasonable justification, for example [1 max]:*** • it is difficult to spot outliers for fewer than three trials • you can be sure you have reliable data • you can calculate the mean/average	*Do **not** accept references to accuracy*	**2**	B

5	**a**	How does the CSA affect the air speed needed for it to float?	*WTTE*	**1**	B
	b	38 cm^2		**1**	D
	c	***Column title:*** CSA ***and*** unit ***Column title:*** speed ***and*** unit Units in column header only All data recorded ***and*** arranged in order	*Accept area for CSA* *Accept table arranged in columns or rows* *Accept ecf from part b* *Accept either ascending or descending*	**4**	C
	d	Graph C Allows for a straight line to be drawn Arranges IV and DV so that relationship can be determined		**3**	C
	e	(If hypothesis supported) a graph of $1/v^2$ ~ CSA would be a straight line (going through the origin) Graph C shows this trend (Therefore) the hypothesis is supported ***or*** (If hypothesis supported) two sets of data would show same constant Data used to demonstrate this (Therefore) the hypothesis is supported	*Award one mark only if candidate has stated there is an (inverse) relationship* *Do **not** award the third mark unless either of the first two marks are awarded* *Seen or implied* *Do **not** award the third mark unless either of the first two marks are awarded*	**3**	C
	f	Repeats measurements ***or*** increases the number of trials Reduces the effect of (random) errors ***or*** increases reliability		**2**	C

6	**a**	Scatter / line graph Graph of weight against volume (of boat) below the water *x*-axis: weight of boat ***and*** *y*-axis: volume of boat below the water	*Accept displaced.*	**3**	C
	b	<u>Straight</u> line through the points Line goes through the origin		**2**	C
	c	***Any reasonable improvement, for example: [2 max]*** • greater range • more trials • regular increment ***Correctly linked effect, for example: [2 max]*** • gives more evidence for a proportional relationship over a greater range • reduces experimental uncertainty • better evidence for an observed trend		**4**	C

d

	1 mark	2 marks	3 marks
1. RQ **(Research question)**	Research question links IV and DV	Research question links IV and DV and refers to a control variable	
2.E **(Equipment)**	Specific equipment for measuring mass of boat/cup eg top pan balance	Specific equipment for measuring mass of boat/cup eg top pan balance, ***and*** equipment to monitor at least one control variable	
3. V **(IV and DV)**	IV identified as mass of salt (weight or density accepted) ***or*** DV identified as mass (weight) of boat/cup	IV identified as mass of salt (weight or density accepted) ***and*** DV identified as mass (weight) of boat/cup	
4. M **(Method)**	Attempt at a method but detail is insufficient to follow	Method described and could easily be followed by another student including reference to control of the control of displacement (eg measured line on the boat/cup)	
5. D **(Data)**	Method implies a range of values of the IV (eg. mass of salt added)	Method implies a range of values of the IV (eg. mass of salt added) with at least 3 trials/repeats	Method implies a range of values of the IV (eg. mass of salt added) with 3 trials/repeats ***and*** plans to calculate average (mean)

11 B

<table>
<tr><td>7</td><td>a</td><td>Long enough half-life to record images

Short enough to prevent long term exposure</td><td></td><td>2</td><td>D</td></tr>
<tr><td></td><td>b</td><td>Any two reasonable advantages, for example [2 max]:
• gamma rays are not blocked by bone or skin
• they do not damage cells (by ionisation)
• they can be detected by a gamma camera</td><td>Do not accept references to half-life.</td><td>2</td><td>D</td></tr>
<tr><td></td><td>c</td><td colspan="3">
<table>
<tr><th></th><th>1 mark</th><th>2 marks</th><th>3 marks</th><th>4 marks</th></tr>
<tr><td>1. A

(Advantages)</td><td>A statement of an advantage</td><td>A statement of two or more advantages
or
A statement of one advantages with an explanation</td><td>A statement of two or more advantages with at least one explained</td><td>A statement of two or more advantages with at least one explained and linked to the specific country</td></tr>
<tr><td>2. D

(Disadvantages)</td><td>A statement of a disadvantage</td><td>A statement of two or more disadvantages
or
A statement of one disadvantage with an explanation</td><td>A statement of two or more disadvantages with at least one explained</td><td>A statement of two or more disadvantages with at least one explained and linked to the specific country</td></tr>
<tr><td>3. C

(Conclusion)</td><td>A simple conclusion</td><td></td><td></td><td></td></tr>
</table>
</td><td>9</td><td>D</td></tr>
</table>

<table>
<tr>
<td>8</td>
<td></td>
<td>
<table>
<tr><th></th><th>1 mark</th><th>2 marks</th><th>3 marks</th><th>4 marks</th></tr>
<tr><td>1. Ad/Dis

(Advantages and disadvantages)</td><td>States either an advantage or disadvantage</td><td>An advantage and disadvantage</td><td>An advantage and disadvantage one of which is supported with scientific understanding</td><td>An advantage and disadvantage both of which are supported with scientific understanding</td></tr>
<tr><td>2. P

(Political implications)</td><td>General reference to a factor relating to government or public affairs</td><td>Specific reference to a factor relating to government or public affairs with an example (eg public safety)</td><td>More than one specific reference to a governmental responsibility each with an example</td><td></td></tr>
<tr><td>3. E

(Environmental implications)</td><td>General reference to an environmental implication</td><td>A specific environmental implication with an example</td><td></td><td></td></tr>
<tr><td>4. A

(Appraisal)</td><td>A simple conclusion</td><td>A concluding appraisal with reference to issues raised</td><td></td><td></td></tr>
</table>
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<td></td>
<td>11</td>
<td>D</td>
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