Markscheme

November 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
	Text 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

<table>
<tr><th colspan="2">Question</th><th>Answers</th><th>Notes</th><th>Total</th><th>Criterion</th><th>Level</th></tr>
<tr><td rowspan="3">1</td><td>a</td><td>
<table>
<tr><th>Symbol</th><th>Quantity</th><th>Unit</th></tr>
<tr><td>p</td><td>momentum</td><td>Ns or kg m s^{-1}</td></tr>
<tr><td>m</td><td>mass</td><td>Kg</td></tr>
<tr><td>v</td><td>velocity</td><td>m s^{-1}</td></tr>
</table>
two correct
all correct</td><td></td><td>2</td><td>Ai</td><td>1-2
1-2</td></tr>
<tr><td>b</td><td>the train has a greater mass or the train is heavier</td><td></td><td>1</td><td>Ai</td><td>1-2</td></tr>
<tr><td>c</td><td>the ball has forward momentum

a force is required to change (an object’s) momentum

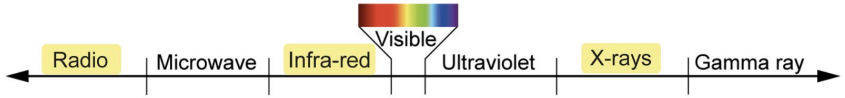
as no force is available to change the momentum (the ball keeps moving)

or

(initially) the ball is moving forward and with the train (at 5 ms^{-1})

(Newton’s first law states that) an object’s velocity will stay the same unless a force acts on it or any correct reference to inertia

there is no net force acting so the velocity will not change</td><td>WTTE</td><td>3</td><td>Aii</td><td>5-6
5-6
5-6</td></tr>
<tr><td>d</td><td><u>Friction</u> (creates a force that prevents the bag from moving)</td><td></td><td>1</td><td>Ai</td><td>3-4</td></tr>
</table>

2	**a**	P = IV *or* I = P/V *or* 1100/220 5 A ***or*** amp(s) ***or*** ampere(s)	 *Award 2 marks for answer with no calculation* *Award this unit mark independently*	**3**	Ai Aii Diii	3-4 3-4 5-6
	b	(electrons carry negative charge so) dust becomes negatively charged reference to attraction between opposite charges	*WTTE*	**2**	Aiii	5-6 5-6
	c	dust particles interfere with this field making it weaker ***or*** addition of negative charges to the positive plate reduces / neutralizes the overall (positive) charge (so) force of attraction is weaker	*WTTE*	**2**	Aii	3-4 3-4
3	**a**	 Responses must be in the correct location either above or below the line		**1**	Ai	1-2
	b	***Any reasonable suggestion, for example [max 1]*** • infrared does not pass through fur • infrared could adversely affect health • infrared could cause a heating effect • infrared has higher energy than radio waves	*ORA*	**1**	Aiii	3-4
	c	$v = f\lambda$ *or* 134000 x 2238 299892000 (ms^{-1}) 2.99892×10^8 ***or*** $3(.00) \times 10^8$ (ms^{-1})	 *Award 2 marks for 29989200 with no calculation shown* *Award 1 mark for 3(.00) x 10^8 with no calculation* *Ignore incorrect units*	**3**	Aii Diii	3-4 3-4 3-4
	d	induction requires no internal power source alternative power source would lose power over time (requiring a replacement RFID or battery) ***or***		**2**	Aiii	3-4 3-4

		an internal power source would be too large				
	e	(AC in the scanner coil produces an) alternating magnetic field / flux the magnetic field passes through the cat to the RFID changing field in the RFID generates an emf in the RFID	*WTTE*	**3**	Aii	5-6 5-6 7-8

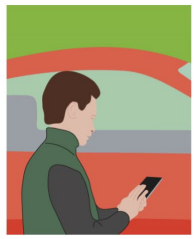
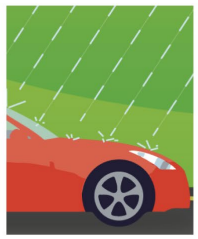
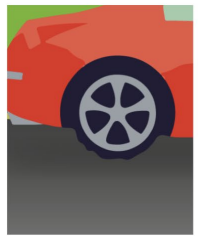
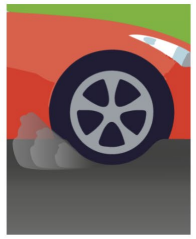
4	a	how does the angle between 2 (plane) mirrors affect the number of images?	*WTTE* *Accept responses phrased as questions only*	1	Bi	1-2
	b	Table Object Independent variable / Dependent variable / Control variable The object used: ☐ / ☐ / ☒ The position of the object: ☐ / ☐ / ☒ The number of images observed: ☐ / ☒ / ☐ The size of the mirrors used: ☐ / ☐ / ☒ The angle between the mirrors: ☒ / ☐ / ☐ The shape of the mirrors used: ☐ / ☐ / ☒ IV – the angle between the mirrors only DV – the number of images observed only CV – the position of the object ***and*** the object used ***and*** the size of the mirrors used ***and*** the shape of the mirrors used ***only***		3	Biii	1-2 1-2 1-2
	c	protractor		1	Biv	3-4
	d	92 ± 2 (°)		1	Cii	1-2
	e	as angle increases number of images decreases conditions of inverse proportion clearly stated or implied in calculation N = *k*/Angle ***or*** if angle is doubled, the number of images is not halved data from the graph correctly used to show that relationship is not inversely proportional	*Award separately and ignore any further incorrect comment linked to inversely proportional relationship* *Award three marks if the first marking point is implied in the last marking point*	3	Ciii	1-2 7-8 7-8
	f	***Any reasonable explanatory points, for example [max 2]*** • DV is not continuous • only integer values of numbers of images are allowed • comparison between angles is easier	*Accept discrete variable*	2	Ci	5-6 7-8
	g	(the second student because) there are more data points ***or*** (the second student because) data are taken at regular intervals increased number of measurements over the range shows the pattern more clearly	*WTTE*	2	Civ	3-4 3-4

5	a	distance noted as being 220m evidence of use of speed equation (distance/time) rounded correctly to 2sf 280 m s^{-1}	 *Award third marking point if an incorrect value is rounded correctly to 2sf*	3	Cii Diii	5-6 3-4 7-8
	b	increase the number of time measurements at this distance (because this will) improve reliability by minimising the effect of random errors in timing increase the overall time for the sound to travel by increasing the distance to the wall (because) small timing errors (due to human reactions) become less significant if the overall time is longer	*WTTE* *Do **not** award marks if additional equipment is used*	4	Cv	5-6 7-8 5-6 7-8
	c	2.65±0.03 ***and*** 0.90±0.03 (2.65– 0.90 =) 1.75 ± 0.06 (s)	 *Award 2 marks for the correct value*	2	Cii	3-4 3-4
	d	***Column Headers:*** Distance (travelled) ***and*** time results in order ***Units in column heading only:*** m ***and*** s data rounded to 2 dp and recorded correctly including their value from part c	*Accept tables presented in rows* *ecf from part (c)*	4	Ci	1-2 5-6 3-4 5-6

	e	correct gradient of LOBF speed = 330 to 355 (m s^{-1})	*seen or implied* *Ignore rounding*	2	Cii	5-6 5-6
	f	identification of data point at 400m or 1s time is too low – should be greater to follow the trend and be closer to the LOBF	 *WTTE*	2	Cii	1-2 3-4
	g	sound faster at higher temp temp linked to kinetic energy ***or*** speed of particles time between collisions is reduced ***or*** faster rate of energy transfer		3	Cii	1-2 7-8 7-8

<table>
<tr>
<td>6</td>
<td>a</td>
<td>
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Variables</td><td>time implied as only dependent variable or
mass implied as only independent variable</td><td>independent variable of mass and dependent variable of time period of oscillation stated</td><td>independent, dependent variable and one control variable stated and justified</td><td>independent, dependent variable and two control variables are stated and justified</td></tr>
<tr><td>Hypothesis</td><td>attempt at a hypothesis linked to either mass or time period</td><td>testable hypothesis linking mass and time period</td><td>hypothesis links IV and DV, is testable and with an attempted explanation referencing relevant scientific knowledge</td><td></td></tr>
<tr><td>Method</td><td>attempt at a method linked to mass and time</td><td>attempt at method, insufficient detail and not likely to give relevant data</td><td>method described, could be followed, will produce relevant data</td><td>complete method fully explained and could be replicated</td></tr>
<tr><td>Data collection</td><td>reference to different increments or trials</td><td>at least five different masses on the spring or three trials</td><td>at least five different masses on the spring and three trials</td><td></td></tr>
</table>
</td>
<td>14</td>
<td>Biv</td>
<td>4x1-2
4x3-4
4x5-6
2x7-8</td>
</tr>
</table>

6	b	***Any relevant IV, for example [max 1]*** • different spring (constant or length) • different number of springs • different initial displacement DV identified or implied as time period research question is consistent with variables identified mass identified as control variable 1 other control variable identified	*Award RQ mark separately – ignore CON in marking points 2-4* *Do **not** allow repetition of mass on spring from part (a)* *Do **not** allow CON to other variables here*	5	Biii Biii Biii	3-4 3-4 3-4 3-4 3-4

7	a	$v^2 = u^2 + 2as$ **or** $u^2/2a = s$ $400/(2*2) = s$ $s = 100$ m	*Accept use of* $s = ut + 1/2at^2$ *Award the unit mark separately*	**4**	Aii	3-4 5-6 5-6 5-6
	b	 Using a cell phone driver factor  Heavy rain environmental factor  Worn out tyre tread car factor  Faulty brakes car factor  Drinking alcohol driver factor  Poor road surface environmental factor 2 correct 1 mark all correct 2 marks		**2**	Di	1-2 1-2

	c	***Alcohol:*** increases time taken (for the brain) to respond ***or*** delayed reactions so stopping distance ***or*** thinking distance increases ***Poor road surface:*** <u>friction</u> is lower on a poor road surface so stopping distance ***or*** braking distance increases	*WTTE*	**4**	Dii	3-4 3-4 3-4 3-4

8			**1**	**2**	**3**	**4**	**14**	Dii	4x1-2 4x3-4 3x5-6 3x7-8
		Driverless technology	an incomplete statement about a feature of DT	a statement of one feature of DT related to safety	description of one feature of DT or statements about two features of DT related to safety	description of more than one feature related to safety			
		Society	an incomplete statement of societal implications	one advantage ***or*** one disadvantage about society	one advantage ***and*** one disadvantage about society clearly stated	more than one advantage ***and*** more than one disadvantage about society clearly stated			
		Economic	an incomplete statement about economic implications	one advantage ***or*** one disadvantage about economic implications	one advantage ***and*** one disadvantage about economic implications	more than one advantage ***and*** more than one disadvantage about economic implications			
		Concluding appraisal	a brief concluding appraisal	a concluding appraisal linking all arguments					