Name: _____

Year 11 Lecture 3 Follow-up Questions

ANSWERS

Date:

Time: 45 minutes

Total marks available: 36

Total marks achieved: _____

Mark Scheme

Q1.

Question Number	Acceptable Answer		Additional guidance	Mark
(a)	• Use of $v = u + at$ • Max acceleration from 0-60 time = 2.8 ($m\ s^{-2}$)	(1) (1)	Example of calculation $\frac{(60 \times 1600)\ m}{(60 \times 60)\ s} = 0 + a \times 9.5\ s$ Max acceleration = 2.8 $m\ s^{-2}$	2

Question Number	Acceptable Answer		Additional guidance	Mark
(b)	• Use of $v^2 = u^2 + 2as$ • Max speed with manufacturer's acceleration = 18 $m\ s^{-1}$ **Or** acceleration shown by police = 3.3 $m\ s^{-2}$ • Decision **and** evidence required consistent with calculated values	(1) (1) (1)	Examples for MP3: e.g. 18.3 $m\ s^{-1}$ is lower than 20 $m\ s^{-1}$ so should be challenged e.g. 18.3 $m\ s^{-1}$ is lower than the maximum speed so should be challenged e.g. The police are suggesting a greater acceleration than the manufacturers, so it should be challenged e.g. The maximum speed achievable is less than that suggested by the police, so it should be challenged MP2: maximum manufacturer's speed with show that value of acceleration = 19.0 $m\ s^{-1}$ Example of calculation $v^2 = 0^2 + 2 \times 2.8\ m\ s^{-2} \times 60\ m$ $v = 18.3\ m\ s^{-1}$	3

Question Number	Acceptable Answer		Additional guidance	Mark
(c)	• Air resistance increases with speed so acceleration decreases (at higher speeds) • The car could brake with greater negative acceleration/force than the positive acceleration/force	(1) (1)	Ignore references to the mass of the car Accept friction for air resistance	2

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
	• Attempt to find area under the graph (1) • Length from 18 000 m to 20 000 m (1) • Comparison of calculated value to 23 km (1) e.g. The length is long enough	MP1: use of triangles or counting squares MP3: conclusion to be consistent with calculated value Example of calculation Area under the graph (counting large squares) = 18.7 × 100 m s^{-1} × 10 s = 18 700 m	3

Q3.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• Two straight lines drawn between points (0, 31) to (0.6, 31) and (0.6, 31) to (10.6, 0) **(1)**		1
(ii)	• Use of area under graph or equations of motion to determine distance **(1)** • Distance travelled = 170 m which is less than 180 m so concludes car stops without colliding **(1)**	Example of calculation distance = (0.6 s x 31 m s^{-1}) + (10 s × 31 m s^{-1}) /2 = 174 m	2

Q4.

Question Number	Acceptable Answers	Mark
(a)(i)	Measures the final interval = 2.2 cm **Or** measures the total distance = 14.6cm **(1)** Velocity = 1.1 (ms^{-1}) **(1)** (independent marks, even if MP1 not awarded, 2nd mark can be awarded if value rounds to 1.1(ms^{-1})) <u>Example of calculation</u> $\text{Velocity} = \frac{0.022\,\text{m}}{0.02\,\text{s}}$ or $\text{Velocity} = \frac{0.146\,\text{m} \times 2}{0.02\,\text{s} \times 13}$ Velocity = $1.1\ \text{m s}^{-1}$	**2**

Question Number	Acceptable Answers	Mark
(a)(ii)	Use of $a = \frac{v-u}{t}$ or suitable equation of motion to calculate a **(1)** a = 4.2 or 4.3 m s^{-2} (allow full ecf for values substituted from (i)) **(1)** (in (i) and (ii) only penalise once for use of 14 gaps) <u>Example of calculation</u> Using $a = \frac{v-u}{t}$ $a = \frac{1.1\,\text{m s}^{-1} - 0}{13 \times 0.02\,\text{s}}$ a = 4.2 m s^{-2}	**2**

Question Number	Acceptable Answers	Mark
(b)	No friction/drag between tape/trolley and timer. **Or** The computer does the calculation **Or** Student doesn't calculate velocity **(1)** (NOT precision, accuracy, plots graph automatically, reaction time, parallax, human error)	**1**
	Total for question	**5**

Q5.

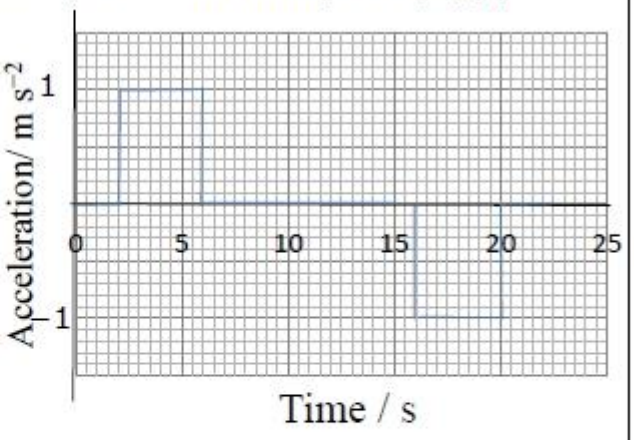
Question Number	Answer	Mark
	C 42 m	**1**
	Incorrect Answers: A – 141 m is ¾ of the internal circumference of the track (¾ × 2 × π × 30 = 141 m) B – 141 m is ¼ of the internal circumference of the track (¼ × 2 × π × 30 = 47 m) D – 30 m (the radius) is the displacement travelled in one direction (downwards from the start position)	

Q6.

Question Number	Answer	Mark
	A area under an acceleration-time graph	**1**
	Incorrect Answers: B – this is equivalent to the displacement C – this is equivalent to the rate of change of acceleration D – this is equivalent to the acceleration	

Q7.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• use of acceleration = gradient of a velocity-time graph (1) • a = 1.0 m s^{-2} (1)	Accept use of $a = \frac{v-u}{t}$ Example of calculation $a = \frac{(3.0\ \text{m s}^{-1} - 0.3\ \text{m s}^{-1})}{(5.60\ \text{s} - 3.00\ \text{s})}$ a = 1.04 m s^{-2}	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	• initial positive acceleration between 2 s and 6 s **Or** final negative acceleration between 15 s and 19 s (1) • region of zero acceleration between 6.0 s and 15.0 s (1) • magnitude of accelerations = 1 m s^{-2} (1)	± 1.0 s tolerance for plotted times ecf for candidate's value of acceleration from part (a)(i)  	**(3)**

Q8.

Question Number	Answer	Mark
	B distance	**1**
	Incorrect Answers: A – acceleration is a vector quantity C – momentum is a vector quantity D – velocity is a vector quantity	

Q9.

Question Number	Answer		Mark
(a)	Same (downwards) acceleration **Or** acceleration = g (accept constant acceleration)	(1)	1
(b)(i)	The ball is in contact with the floor (accept the ball bounces)	(1)	1
(b) (ii)	Lower gradient **Or** the lines would be not be as steep	(1)	1
(c)	Use of equation(s) of motion to find s **Or** use of distance = area under the graph **Or** use of GPE = KE s = 1.1 m – 1.4 m Example of calculation $(4.7\ \text{m s}^{-1})^2 = (0\ \text{m s}^{-1})^2 + (2 \times 9.81\ \text{m s}^{-2} \times s)$ s = 1.13 m	(1) (1)	2
(d)(i)	Use of KE = ½ mv^2 KE = 1.1 – 1.3 (J) (no ue) Example of calculation KE = ½ × 0.40 kg × $(2.4\ \text{m s}^{-1})^2$ = 1.15 J	(1) (1)	2
(d)(ii)	Use of GPE = KE h = 0.27 m – 0.32 m (ecf from 16(d)(i)) (If area under graph or an equation of motion is used e.g. $h = \frac{(u+v)t}{2}$ or $v^2 = u^2 + 2as$ only MP2 can be scored) Example of calculation $h = \frac{1.2\ \text{J}}{0.4\ \text{kg} \times 9.81\ \text{Nkg}^{-1}}$ h= 0.31 m	(1) (1)	2
(e)	(Elastic potential) energy transferred to thermal energy **Or** energy dissipated as heat	(1)	1
	Total for question		10