Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 2 (Mechanics)

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Name of the Student:______________________________

Max. Marks : 23 Marks **Time : 23 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answer		Additional Guidance	Mark
(a)(i)	• no net force on bridge • no net moment of force about any point	(1) (1)	Alternative wording that implies these 2 points will be accepted	**(2)**
(a)(ii)	• use of $W = mg$ to find the weight of the bridge • use of moment = $F\,x$ • applies principle of moments • $F_A = 43610$ N • applies equilibrium of forces or applies principle of moments about a different point to obtain $F_B = 45990$ N	(1) (1) (1) (1) (1)	<u>Example of calculation:</u> $W = mg = 8500$ kg $\times 9.8$ N kg^{-1}= 83300 N Taking moments about A, Clockwise moments = (1500 N × 4 m) + (4800 N × 6.5 m) + (83300 N × 9.5 m) Anticlockwise moments = $F_A \times 19$ m 19 N × F_A = 828550 Nm F_A = 828550 Nm/19 m = 43610 N $F_A + F_B$ = 1500 N + 4800 N + 83300 N F_B = 89600 N − 43610 N = 45990 N	**(5)**

Question Number	Acceptable Answer		Additional Guidance	Mark
(b)(i)	• resonance occurs when the bridge is forced into oscillation at its natural frequency • this results in an increasing amplitude of oscillation of the bridge, which may damage the bridge	(1) (1)		**(2)**
(b)(ii)	• energy was transferred from the oscillating bridge to the dampers • this energy was dissipated in the dampers (and not returned to the bridge) • hence the amplitude of oscillation was kept small	(1) (1) (1)		**(3)**
(b)(iii)	• as the viscosity of the fluid increased the fluid would offer greater resistance to movement [accept reverse argument] • a greater resistance to movement would result in a greater energy dissipation	(1) (1)		**(2)**

Q2.

Question Number	Answer		Mark
(a) (i)	Each row of the table contains a suitable method. One mark for each column, do not allow a mix and match of methods (rows)	(1) (1) (1) (1)	

Distance measured with the metre rule	**Corresponding time**	**Correct use of measurements referred to in columns 1 and 2**	**To calculate g use:** (formula/expression seen)
Record the position on the **rule** for each frame	Time between frames	Plot distance against t^2	g = 2 x gradient
Measure distance between (successive) frames against a metre **rule**	Time between frames	Calculate the speed each frame using distance /time and plot against time	g = gradient
Use metre **rule** to measure: (total) distance ball falls through **Or** height from which the ball was dropped (e.g. 1 m)	Number of frames × time between frame **Or** total time of journey recorded/found	Use of: $s = ut + ½ at^2$ **Or** $s = ½ at^2$ **Or** $s = ½ gt^2$	$g = 2s/t^2$ **Or** Re-arrange $s = ½ gt^2$ substituting in s and t to find g.
Measure distance between frames (at beginning and) end of drop using the **rule**	Time between frames known and count frames **Or** if stated $u = 0$ then time for ball to fall and the time between frames.	Use speed = $\Delta s/\Delta t$ to find their final velocity using correct time interval [may take u as 0]	$g = (v-u)/t$ **Or** $a = (v-u)/t$
Record the position on the **rule** each frame	Time between frames	Calculate the speed each frame using d/t and plot a graph of v^2 against s.	Gradient/2 = acceleration

Accept metre stick or ruler in place of metre rule
(The candidate may refer to the acceleration of free fall as '*a*' or 'g')

(a) (ii)	Ball may be released between 1st and 2nd images (so times used all too long because they include a short time before it is dropped) **Or** ball released before the 1st image so u is not 0 **Or** the ruler is not vertical/straight **Or** the idea that the camera has not been calibrated correctly i.e. runs too fast/slow **Or** the idea that there is a parallax error from camera to object (Parallax alone is insufficient) (Do not award a mark for air resistance)	**(1)**	**1**
(b)	Small / dense / streamlined shape / smooth surface / shiny Correct explanation, e.g.: Small surface area– minimise drag Dense – weight > upthrust **Or** weight > drag Streamlined /aerodynamic– minimise drag **Or** ensure laminar flow Smooth surface – minimise drag **Or** ensure laminar flow Shiny – easy to see on the recording Small – easier to read scale (precisely) (Sphere is not acceptable for a property but statement such as 'sphere to minimise drag' can score 2nd mark)	**(1)** **(1)**	**2**
(c)	Advantage Explanation (to score both marks the explanation must be linked to the advantage. Accept reverse arguments. Human error is not sufficient for reaction time).	**(1)** **(1)**	**2**

Advantage	Explanation
No reaction time	Reduces uncertainties **Or** (time recorded) more precise/accurate
Can be paused /stopped to take readings.	Measurements taken at exact times **Or** positions against rule recorded more accurately. **Or** velocities can be calculated frame by frame (more readings
Allows repeated playback **Or** rewinding	Allows values to be checked/confirmed **Or** values obtained are more reliable