Practice Question Set For A-Level

Subject : Physics

Paper-1 Topic : 2 (Mechanics)

Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:____

Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

Question number	Acceptable answers	Additional guidance	Mark
	• Recognises that weight acts at midpoint of diving board 1.8 (m) from X **(1)** • Use of moment = perpendicular force x distance **(1)** • Total clockwise moment = 3150 Nm **(1)** • Recognises that clockwise moment = anticlockwise moment **(1)** • *F*=3500 N **(1)**	Example of calculation: Total clockwise moment = (680x3.6)+(390x1.8) = 3150 Nm *F* = 3150/0.9 = 3500 N	5

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• Use of $F = \frac{GMm}{r^2}$ with $F = \frac{mv^2}{r}$ (1) • Correct substitutions to calculate r (1) • $h = 5.4 \times 10^5$ m (1) **OR** • Use of $g = \frac{GM}{r^2}$ to find value of g at orbit height (1) • Use of $a = \frac{v^2}{r}$ with value of g at orbit height (1) • $h = 5.4 \times 10^5$ m (1)	Example of calculation: $\frac{GMm}{r^2} = \frac{mv^2}{r}$ $r = \frac{GM}{v^2}$ $r = \frac{6.67\times10^{-11}\text{ N m}^2\text{kg}^{-2}\times5.97\times10^{24}\text{ kg}}{(7.59\times10^3\text{ m s}^{-1})^2}$ r=6.91×10⁶m → $r = 6.91\times10^6$ m $\therefore h = (6.91\times10^6 - 6.37\times10^6)\text{ m} = 5.42\times10^5\text{ m}$	3
(ii)	• Use of $GPE = \frac{GMm}{r}$ (1) • GPE = 5.7×10^{10} J (1) (ecf from (a)(i))	Example of calculation: $GPE = GMm\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$ $\therefore GPE = 6.67\times10^{-11}\text{Nm}^2\text{kg}^{-2} \times 5.97\times10^{24}\text{ kg} \times 11600\text{ kg}\left(\frac{1}{6.37\times10^6\text{m}} - \frac{1}{6.91\times10^6\text{m}}\right)$ $\therefore GPE = 5.67\times10^{10}$ J	2

Question Number	Acceptable Answer	Additional Guidance	Mark
(iii)	• This would bring the gravitational potential energy closer to zero (1) • This would mean that the satellite would orbit at a greater height as $GPE \propto \frac{1}{r}$ (1) • To remain in orbit the centripetal acceleration must equal the gravitational field strength at the orbit height **Or** Since gravitational force smaller, $\frac{mv^2}{r}$ would be reduced (1) • (Hence) r is greater so v must be smaller **Or** $v^2 = \frac{GM}{r}$ and satellite would orbit at lower speed (1) **OR** • HST will have more kinetic energy at the original orbit height (1) • The centripetal force will be too small to keep it in this orbit (1) • The satellite would be travelling too fast, so it would move to a higher orbit (1) • (Hence) r is greater so v must be smaller **Or** $v^2 = \frac{GM}{r}$ and satellite would orbit at lower speed (1)		4

Q3.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	• attempts to find area under second peak <u>OR</u> use of a suitable equation of motion <u>OR</u> equate $E = \frac{1}{2}mv^2$ and $\Delta E = mg\Delta h$ (1) • height = 0.9 - 1.0 m (1)	<u>Example of calculation:</u> $h = \frac{1}{2} \times 4.2\ \text{m s}^{-1} \times (1.2-0.70)\ \text{s} = 1.0$ m	**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)	• use of $\Delta E = mg\Delta h$ <u>OR</u> use of $E = \frac{1}{2}mv^2$ (1) • ΔE =0.59 J (1)	<u>Example of calculation:</u> $E = 0.060\ \text{kg} \times 9.81\text{m s}^{-2} \times (2.0 - 1.0)\text{m}$ $E = 0.59$ J	**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	<u>EITHER</u> • finds gradient of middle section (1) • use of $F = ma$ (1) • $F = 64$ N (1) <u>OR</u> • reads two corresponding pairs of *v* and *t* from middle section of graph (1) • use of $F = \frac{m(v-u)}{\Delta t}$ (1) • $F = 64$ N (1)	<u>Example of calculation:</u> $F = \frac{(6.3+4.2)\ \text{m s}^{-1}}{(0.74-0.64)\ \text{s}} \times 0.060\ \text{kg} = 64$ N	**(3)**

Question Number	Acceptable Answer	Additional guidance	Mark
(d)	Initial free-fall • gradient of both graphs is the same (1) Bounce section • the gradient of the soft ball graph is less (1) Second free-fall • gradient of the soft ball graph is the same as the first graph OR the gradient is the same as in the initial free-fall (1)	Accept the first line is the same Accept time for the bounce is longer	**(3)**