Gravity Answers

1. A **[2]**

2. D **[2]**

3. C **[2]**

4. (a) 360 N **(1)** 1

(b) (i) ($E_p = mgh$ gives) $E_p = 720 \times 0.6 = 4.3 \times 10^2$ J **(1)**

(ii) $T \cos 20°$ **(1)** = 360(N)
T = 380 N **(1)**
(allow e.c.f from(a)) 3

(c) (potential energy) changes **(1)**
centre of mass/gravity moves upwards **(1)** 2
QWC

[6]

5. (a) (i) $E\ (= \frac{Q}{4\pi\varepsilon_0 r^2}) = \frac{29 \times 1.6 \times 10^{-19}}{4\pi \times 8.85 \times 10^{-12} \times (1.15 \times 10^{-10})^2}$ **(1)**

$= 3.15 \times 10^{12}$ Vm^{-1} (or (NC^{-1}) **(1)**

(ii) $V(= -\frac{GM}{r}) = (-)\frac{6.67 \times 10^{-11} \times 63 \times 1.66 \times 10^{-27}}{1.15 \times 10^{-10}}$ **(1)**

= (–) 6.07×10^{-26} **(1)** – sign and J kg^{-1} 5

(b) arrow pointing to the right **(1)** 1

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6. (a) period = 24 hours or equals period of Earth's rotation **(1)**
remains in fixed position relative to surface of Earth **(1)**
equatorial orbit same angular speed as Earth or equatorial surface **(1)** max 2

(b) (i) $\frac{GMm}{r^2} = m\omega^2 r$ **(1)**

$T = \frac{2\pi}{\omega}$ **(1)**

$r\left(=\frac{GMT^2}{4\pi^2}\right)^{1/3} = \left(\frac{6.67\times10^{-11}\times 6\times10^{24}\times(24\times3600)^2}{4\pi^2}\right)^{1/3}$ **(1)**

(gives $r = 42.3 \times 10^3$ km)

(ii) $\Delta V = GM\frac{1}{R} - \frac{1}{r}$ **(1)**

$= 6.67 \times 10^{-11} \times 6 \times 10^{24} \times \left(\frac{1}{6.4\times10^6} - \frac{1}{4.23\times10^7}\right)$

$= 5.31 \times 10^7$ (J kg^{-1}) **(1)**

$\Delta E_p = m\Delta V$ (= $750 \times 5.31 \times 10^7$) = 3.98×10^{10} J **(1)**
(allow C.E. for value of ΔV)

[alternatives:
calculation of $\frac{GM}{R}$ (6.25×10^7) or $\frac{GM}{r}$ (9.46×10^6) **(1)**
or calculation of $\frac{GMm}{R}$ (4.69×10^{10}) or $\frac{GMm}{r}$ (7.10×10^9) **(1)**

calculation of both potential energy values **(1)**
subtraction of values or use of $m\Delta V$ with correct answer **(1)** 6

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