# Text Book Questions
## Chapter 7

(2) A - to sweep out the same area in the same period of time, the satellite must have a faster speed when closest to the sun.

(3) A

(6) A $g = \frac{Gm}{r^2}$

$$= \frac{(6.67 \times 10^{-11})\, 1.35 \times 10^{23}}{(2.58 \times 10^{6})^2} = 1.35 \text{ m/s}^2$$

(7) A $\frac{mv^2}{r} = \frac{GMm}{r^2}$

$$\frac{4\pi^2 r^2}{T^2} = \frac{Gm}{r}$$

$$r = \sqrt[3]{\frac{GmT^2}{4\pi^2}}$$

$$r = \sqrt[3]{\frac{(6.67 \times 10^{-11})(5.68 \times 10^{23})(15.9 \times 24 \times 3600)^2}{4\pi^2}}$$

$$r = 1.22 \times 10^{8} \text{ m}$$

(8) C  weight is the force of gravity acting on an object.

$\text{weight} = mg \qquad g = \frac{GM}{r^2}$

$\text{weight} = \frac{GMm}{r^2} = \text{gravitational force}$

(10) D  (11) B  (12) C

(14) C  $g = \frac{GM}{r^2} = \frac{(6.67\times10^{-11})(2.31\times10^{21})}{(7.63\times10^{5})^2}$

$g = 0.265 \text{ m/s}^2$

(15) C  $g = \frac{GM}{r^2}$

$G = \frac{gr^2}{M} = \frac{(9.8)(6.371\times10^{6})^2}{5.971\times10^{24}}$

$G = 6.66\times10^{-11} \frac{Nm^2}{kg^2}$

Units: $g \rightarrow \frac{N}{kg}$  $r \rightarrow m$  $M \rightarrow kg$

(16) B

$$\frac{mv^2}{r} = \frac{GMm}{r^2} \qquad v = \frac{2\pi r}{T}$$

$$\frac{4\pi^2 r^2}{T^2} = \frac{GM}{r}$$

$$M = \frac{4\pi^2 r^3}{GT^2}$$

$$= \frac{4\pi^2 (5.791 \times 10^{10})^3}{6.67 \times 10^{-11} (88 \times 24 \times 3600)^2}$$

$$M = 1.99 \times 10^{30} \text{ kg}$$

(18) C

$$\frac{T_{earth}^2}{r_{earth}^3} = \frac{T_{Neptune}^2}{r_{Neptune}^3}$$

$$T_{Neptune} = \sqrt{\frac{r_{Neptune}^3 \, T_{earth}^2}{r_{earth}^3}}$$

$$T_{Neptune} = \sqrt{\frac{(4.490 \times 10^9 \text{ km})^3 (1 \text{ year})^2}{(1.496 \times 10^8 \text{ km})^3}}$$

$$T_{Neptune} = 164 \text{ years}$$

(22) A

$$\frac{T_{moon}^2}{r_{moon}^3} = \frac{T_{satellite}^2}{r_{satellite}^3}$$

$$T_s = \sqrt{\frac{r_s^3 \, T_m^2}{r_m^3}}$$

$$= \sqrt{\frac{(1.45 \times 10^7 \text{ km})^3 \, (27.3 \text{ days})^2}{(3.84 \times 10^5 \text{ km})^3}}$$

$$T_s = 0.200 \text{ days.}$$

(23) B

$$\frac{T_{earth}^2}{r_{earth}^3} = \frac{T_{venus}^2}{r_{venus}^3}$$

$$T_v = \sqrt{\frac{r_v^3 \, T_e^2}{r_e^3}}$$

$$= \sqrt{\frac{(1.08 \times 10^8 \text{ km})^3 \, (365 \text{ days})^2}{(1.496 \times 10^8 \text{ km})^3}}$$

$$= 223.89 \text{ Earth days in 1 Venus year}$$

$$\frac{223.89}{243} = 0.92 \text{ Venus days in 1 Venus year.}$$

(24) B

(25) B

$$\text{Weight} = mg$$

$$g = \frac{W}{m} = \frac{67.9}{55} = 1.23 \text{ m/s}^2$$

(27) B

small mass orbits big mass.

(30) D

$$\frac{T_{Deimos}^2}{r_{Deimos}^3} = \frac{T_{Phobos}^2}{r_{Phobos}^3}$$

$$T_P = \sqrt{\frac{r_P^3}{r_D^3} T_D^2}$$

$$= \sqrt{\frac{(9.374 \times 10^3 \text{ km})^3}{(2.35 \times 10^3 \text{ km})^3} (1.26 \text{ days})^2}$$

$$= 10.0 \text{ days}$$

(31) D

(33) B

$$g = \frac{Gm}{r^2}$$

$$m = \frac{gr^2}{G} = \frac{(9.8)(6.37\times10^6)^2}{6.67\times10^{-11}}$$

$$m = 5.96\times10^{24}\ kg$$

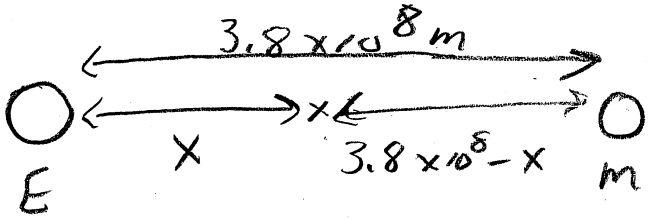
(34) A

$$F = \frac{GMm}{r^2}$$

$$= \frac{(6.67\times10^{-11})(60)(60)}{(100)^2}$$

$$F = 2.4\times10^{-11}\ N$$

(38) A




$$F_1 = F_2$$

$$\frac{GM_E m}{r_1^2} = \frac{Gm_m m}{r_2^2}$$

$$\frac{M_E}{(x)^2} = \frac{m_m}{(3.8\times10^8 - x)^2}$$

38 cont'd

$$5.97\times10^{24}\left(1.444\times10^{17} - 7.6\times10^{8}x + x^2\right) = 7.35\times10^{22}x^2$$

$$8.621\times10^{41} - 4.537\times10^{33}x + 5.97\times10^{24}x^2 = 7.35\times10^{22}x^2$$

$$5.90\times10^{24}x^2 - 4.537\times10^{33}x + 8.61\times10^{41} = 0$$

divide by $1\times10^{24}$

$$5.90x^2 - 4.537\times10^{9}x + 8.61\times10^{17} = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{4.537\times10^{9} \pm \sqrt{(-4.537\times10^{9})^2 - 4(5.90)(8.61\times10^{17})}}{2(5.90)}$$

$$= \frac{4.537\times10^{9} \pm 5.146\times10^{8}}{11.8}$$

$$= \underbrace{4.28\times10^{8}\ m}, \ 3.41\times10^{8}\ m$$

this is greater than the distance between the moon and the earth and therefore cannot be the correct response.

$X = 3.41\times10^{8}\ m = 3.41\times10^{5}$ km from the Earth.