

Test 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

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

$$\frac{4\pi^2 r^3}{T^2} = \frac{GM}{r}$$

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

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

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

⑧ C

Weight is the force of gravity acting on an object.

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

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

⑪ B

⑬ C

$$\text{⑭ C} \quad g = \frac{GM}{r^2} = \frac{(6.67 \times 10^{-11})(2.31 \times 10^{21})}{(7.63 \times 10^5)^2}$$

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

⑮ C

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

$$G = \frac{gr^2}{M} = \frac{(9.8)(6.371 \times 10^6)^2}{5.971 \times 10^{24}}$$

$$G = 6.66 \times 10^{-11} \frac{\text{Nm}^2}{\text{kg}^2}$$

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

(16) B

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

$$v = \frac{2\pi r}{T}$$

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

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

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

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

(18) C

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

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

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

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

(22) A

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

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

$$= \sqrt{\frac{(1.45 \times 10^4 \text{ km})^3 (27.3 \text{ days})^2}{(3.84 \times 10^5 \text{ km})^3}}$$

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

(23) B

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

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

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

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

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

(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

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

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

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

$$= 10.0 \text{ days.}$$

(31) D

(33) B

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

$$M = \frac{gr^2}{G} = \frac{(9.8)(6.37 \times 10^6)^2}{6.67 \times 10^{-11}}$$

$$M = 5.96 \times 10^{24} \text{ kg}$$

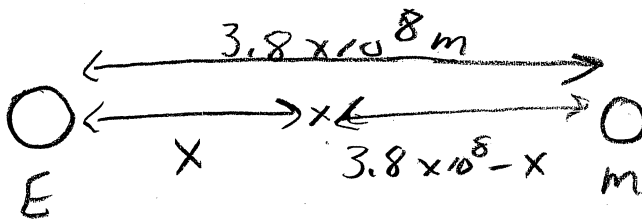
(34) A

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

$$= \frac{(6.67 \times 10^{-11})(60)(60)}{(100)^2}$$

$$F = 2.4 \times 10^{-11} \text{ N}$$

(38) A



$$F_1 = F_2$$

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

$$\frac{M_E}{(x)^2} = \frac{M_m}{(3.8 \times 10^8 - x)^2}$$

38 cont'd

$$5.97 \times 10^{24} (1.444 \times 10^{17} - 7.6 \times 10^8 x + x^2) = 7.35 \times 10^{22} x^2$$

$$8.621 \times 10^{41} - 4.537 \times 10^{33} x + 5.97 \times 10^{24} x^2 = 7.35 \times 10^{22} x^2$$

$$5.90 \times 10^{24} x^2 - 4.537 \times 10^{33} x + 8.61 \times 10^{41} = 0$$

divide by 1×10^{24}

$$5.90 x^2 - 4.537 \times 10^9 x + 8.61 \times 10^{17} = 0$$

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

$$= \frac{4.537 \times 10^9 \pm \sqrt{(-4.537 \times 10^9)^2 - 4(5.90)(8.61 \times 10^{17})}}{2(5.90)}$$

$$= \frac{4.537 \times 10^9 \pm 5.146 \times 10^8}{11.8}$$

$$= \underbrace{4.28 \times 10^8 \text{ m}} , 3.41 \times 10^8 \text{ m}$$

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

$$x = 3.41 \times 10^8 \text{ m} = 3.41 \times 10^5 \text{ km from the Earth.}$$