Homework Set #4 Solutions (9/22 - 9/26):

Chapter 5: Questions 24, 29, 45 Exercises 10, 18, 22

Questions:

24. Because the variation in the force is not usually important for motion near the Earth's surface, we use the simpler form as it gives a very good approximation.

29. We would expect the value of $g$ to be larger because the uranium has a larger mass per cubic meter than the average surface material.

45. The Moon produces a bulge that points only toward the Moon but also away from the Moon. The Sun does the same. The effects will reinforce to produce a larger bulge as long as the individual bulges are aligned. This happens with the Moon and the Sun either on the same side of Earth or on opposite sides.

Exercises:

10. \[ F_{\text{shuttle}} = F_{\text{earth}} \left( \frac{r_{\text{earth}}}{r_{\text{shuttle}}} \right)^2 = F_{\text{earth}} \left( \frac{6400 \text{ km}}{6400 \text{ km} + 400 \text{ km}} \right)^2 = 0.886 \cdot F_{\text{earth}} \]

18. \[ g_{\text{mars}} = g_{\text{earth}} \left( \frac{m_{\text{mars}}}{m_{\text{earth}}} \right) \left( \frac{r_{\text{earth}}}{r_{\text{mars}}} \right)^2 = 10 \text{ m/s}^2 \left( \frac{0.11 m_{\text{earth}}}{m_{\text{earth}}} \right) \left( \frac{r_{\text{earth}}}{0.53 r_{\text{earth}}} \right)^2 = 3.9 \text{ m/s}^2 \]

22. \[ 5^2 = 25 \]

Chapter 6: Questions 6, 11 Exercises 4, 9

Questions:

6. Padded dashboards lengthen the time for the body to stop and therefore reduce the forces involved.

11. The initial momentum is 8 kilogram-meters per second down. It changes to zero, so the impulse is 8 kilogram-meters per second directed up.

Exercises:

4. \[ v_{\text{you}} = \frac{m_{18} v_{18}}{m_{\text{you}}} = \frac{(24,000 \text{ kg})(1 \text{ mph})}{60 \text{ kg}} = 400 \text{ mph} \]
9. \( F \Delta t = \Delta(mv) = 0 - (1500 \text{ kg})(30 \text{ m/s}) = -45,000 \text{ N} \cdot \text{s} \)

\[
F = \frac{\Delta(mv)}{\Delta t} = \frac{-45,000 \text{ N} \cdot \text{s}}{8 \text{ s}} = -5625 \text{ N}
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