Questions

2.) more acceleration on sharp curve

$a_c = \frac{v^2}{r}$ smaller $r \rightarrow$ larger a_c

4.) 

F_g (gravity downwards

$F_\perp$ (pushing back up)

F_c (pulling/pushing child towards center)

5.) centripetal force exceeds gravity when whirled fast enough so water accelerates more in circle as opposed to simply falling.

6.) force of gravity same on apple and earth no matter if attached or falling

7.) doubling mass would double force of gravity. To continue to orbit in a circle, the moon would either have to speed up or be further away.

8.) a slight increase in the gravity experienced would indicate more ore (dense earth) just below.

9.) a.) weight is less b.) weight is more c) no weight

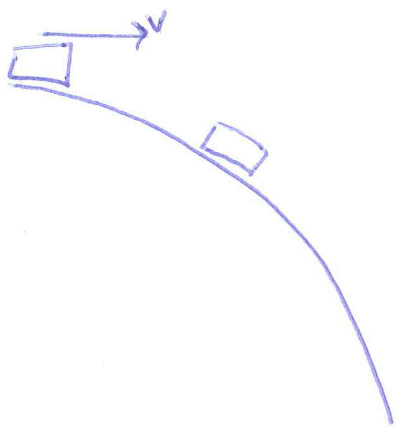
d.) weight is the same.

12.) the centripetal force pushing astronaut towards center is like the $F_\perp$ of the ground pushing up on your feet to counter F_g.

13.) Same F_g. Since moon has less mass, then more accel.

14.) Gas pedal & brakes to increase or decrease speed
Steering wheel to change direction

15.)



F_g acts just like F_c necessary to pull the sled in a circle. The ground does not need to push back up.

16.) To say there is no gravity is incorrect. Satellites have enough velocity to continue "falling" in a circle.

Problems

2.) $a_c = \frac{v^2}{r} = .9375$

$F = ma = (25)(a_c) = 23.4\ N$

4.) $F = ma$ $\quad a = \frac{v^2}{r}$ $\quad V = 11.83\ m/s$

$a = 140$

6.) $F = ma$ $\quad a = \frac{v^2}{r}$ $\quad V = 13.96\ m/s$

$a = 150$

7.) $F_{fr} = \mu F_{\perp} = (.8)(10500\ N) = 8400\ N$

$F = ma$ $\quad a = 8$

$a = \frac{v^2}{r}$ $\quad V = 23.66\ m/s$

8.) $a = \frac{v^2}{r} = 20.26$ $\quad F_c = ma_c$ $\quad F_c = 6.08\ N$

$F_g = 3N$

at top, tension is only 3.08 N as gravity provides the rest of the necessary force

at bottom, tension is 9.08 N as you need to pull harder to cancel gravity and keep ball moving in circle.

a.) $95 \frac{km}{hr} = 26.39\ m/s$

$a = \frac{v^2}{r} = 8.19\ m/s^2$

$F_{fr} = \mu F_\perp = ma$ → $\mu\, m \cdot g = m(8.19)$

~~μF~~

$\mu = \frac{8.19}{9.8} = .836$

9.) oops

$95 \frac{km}{hr} \Big| \frac{1000\ m}{1\ km} \Big| \frac{1\ hr}{3600\ s} = 26.39\ m/s$

$a_c = \frac{v^2}{r} = \frac{26.39^2}{85} = 8.19\ m/s^2$

$F_c = ma_c = F_{fr} = \mu F_\perp$

$m(8.19) = \mu(9.8)m$

$\mu = .836$

10.) $F = 7.75gm = F_c = m\frac{v^2}{r}$

$7.75(10) = \frac{v^2}{r}$

$v^2 = 775$

$v = 27.84\ \frac{m}{s}$

Circumference $= 2\pi r = 62.83\ m$

1 rev = 62.83 m

$\frac{27.84\ m}{s} \Big| \frac{1\ rev}{62.83\ m} = .443\ \frac{rev}{s}$

11.) 36 rpm = $\frac{36\text{ rev}}{\text{min}} \Big| \frac{1\text{ min}}{60\text{ sec}} \Big| \frac{.69\text{ m}}{1\text{ rev}} = .415\ \frac{m}{s}$

$a_c = \frac{.415^2}{.11} = 1.56$

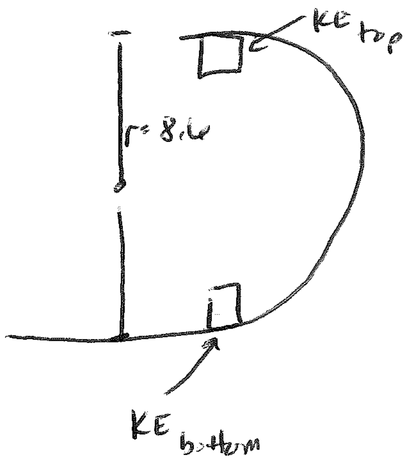
$F_c = F_{fr}$

$m a_c = \mu m g$

$1.56 = \mu(9.8)$

$\mu = .16$

12.)



Bottom		top
KE + PE	=	KE + PE

at the top need a_c = acceleration of gravity

$9.8 = \frac{(v^2)}{8.6}$ $v = 9.18\ \frac{m}{s}$

KE top $= \frac{1}{2}m(9.18)^2 = 42.1m$

PE top $= m(9.8)(17.2) = 168.6m$

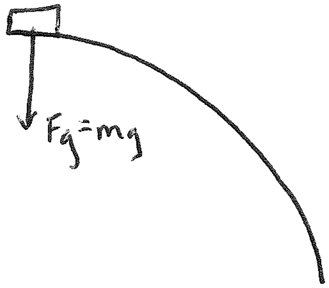
$\underbrace{KE + 0}_{\text{bottom}} = \underbrace{42.1m + 168.6m}_{\text{top}}$

KE = 210.7m

$\frac{1}{2}mv^2 = 210.7m$

$v^2 = 421.4$

$v = 20.5\ m/s$

13.) 

$F_g = 10000\ N$

$F_c = m\frac{v^2}{r} = 4000\ N$

ground only pushes back up with 6000 N so that car experiences 4000 N net force.

c.) when does $F_g = F_c$? when $a_c = (9.8)$

$9.8 = \frac{v^2}{100}$ $v = 31.3\ m/s$

25.) $F = G\frac{(6\times10^{24})(1400)}{(19{,}200{,}000)^2}$ $G = 6.67\times10^{-11}$ $F = 1520\ N$

26.) $a = G\frac{(m)}{r^2} = \frac{(6.67\times10^{-11})(7.35\times10^{22})}{(1.74\times10^{6})^2}$ $a = 1.62\ m/s^2$

27.) if radius increases by factor of 2.5, F decreases by factor $(2.5)^2$
~~F~~ by 6.25

$a = \frac{9.8}{6.25} = 1.57\ m/s^2$

28.) if mass increases by factor of 2.5, F increases by factor of 2.5, so acceleration is $2.5g$ or $\approx 25\ m/s^2$

29.) mass doesnt change, always 2.1 kg

Weight on Earth = $(10)(2.1) = 21\ N$
Weight on planet = $(12)(2.1) = 25.2\ N$

30.) radius of Earth = 6400 km → acceleration of gravity on Earth is 9.8

radius to shuttle = 6700 km

→ radius increases by 5% $1.0468 = \frac{6700}{6400}$

Force (accel) decreases by $(1.0468)^2 = 1.096$

by 9.6%

only 9.6% weaker

31.) $F = G \frac{(m)(m_2)}{r^2}$ $a = G \frac{m}{r^2} = \frac{(6.67\times10^{-11})(5\times2\times10^{30})}{(1000\ m)^2}$

$= 2.7 \times 10^{14}$ N wow!