Force of Gravity (Weight) Practice Name:_____

1. Determine the force of gravity acting on a 35 kg child on Earth.

$$F_g = mg = 35\,kg \times 9.8\frac{m}{s^2} = 343\frac{kg \cdot m}{s^2}$$

$$\approx 340N$$

2. Determine the force of gravity acting on a 350 kg block on Earth.

$$F_g = mg = 350\,kg \times 9.8\frac{m}{s^2} = 3400N$$

3. Explain why the child and the block would have the same acceleration due to gravity (-9.8m/s^2), despite the fact the force of gravity acting on them is different.

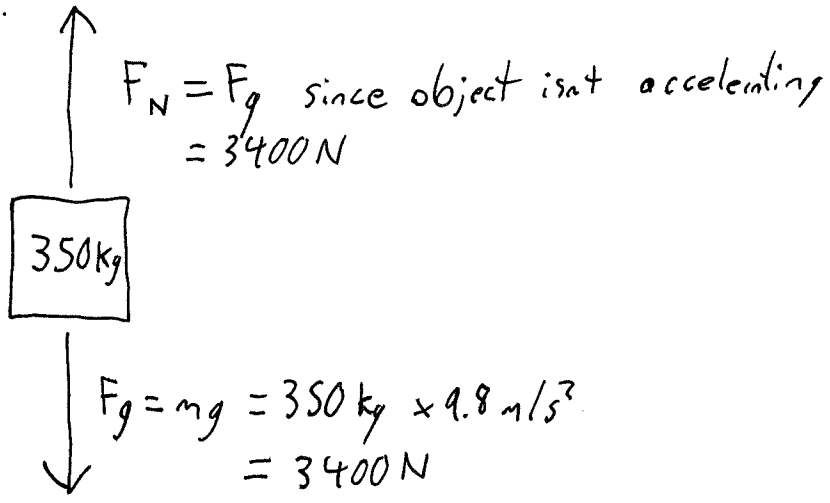
The amount difference is due to mass which cancels out when determining acceleration. IF F_g is only force

$$F_{net} = F_g$$

$$ma = mg \rightarrow a = g$$

$\div m \quad \div m$

4. A 350 kg block sits on a floor, draw a FBD with magnitude of gravitational and normal forces labelled.



Force of Gravity (Weight) Practice Name:_____

5. What is the force of gravity acting on a 63 kg block?

$F_g = mg = 63kg \times 9.8\frac{m}{s^2} = 620N$

6. What is the ~~force of gravity acting on a~~ weight of a 34 kg block?

$Weight = F_g = mg = 34kg \times 9.8\frac{m}{s^2} = 330N$

7. What is the mass of an object if its weight is 560 N on Earth?

$F_g = mg \rightarrow \frac{F_g}{g} = m \qquad \frac{560N}{9.8\frac{m}{s^2}} = 57kg$

8. What is the mass of an object if its weight is 720 N on Earth?

$\frac{F_g}{g} = m \rightarrow \frac{720N}{9.8m/s^2} = 73kg$

9. On the moon g=1.6. What is the weight of a 45 kg object on the moon?

$F_g = mg = 45kg \times 1.6\frac{m}{s^2} = 72N$

10. On the moon g=1.6. What is the mass of an object if its weight is 254 N on the moon?

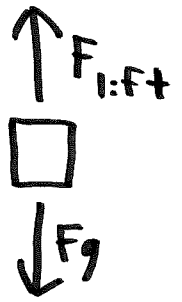
$m = \frac{F_g}{g} = \frac{254N}{1.6\frac{m}{s^2}} = 158.75kg$

$\approx 160\ kg$

Force of Gravity (Weight) Practice Name:_____

11. A 2 500 kg helicopter is hovering above the ground. What is the upward force the rotors are providing?

Not accelerating up or down



$F_{lift} = F_g$

$F_g = mg = 2500\,kg \times 9.8\,\frac{m}{s^2} = 24500\,N$

$\approx$ (25000N)

12. A 25 kg object is falling, and as it falls it is accelerating downwards not at 9.8 m/s^2 but only at 4.3 m/s^2 due to air resistance.
    a. Draw a free body diagram of the object with air resistance and gravity forces shown.

    b. What is the net force acting on the object? (Use Newton's second law)

$F_{net} = ma = 25kg \times 4.3\,\frac{m}{s^2} = 107.5\,N$

$\approx 110\,N$

    c. What is the magnitude of the air resistance force?

F_{net} = Winners − losers

it is accelerating down so Gravity is winner

$245 - 107.5 = 137.5\,N$ Air resistance

$\approx$ (140N)

Force of Gravity (Weight) Practice Name:_____

Apparent Weight

13. A 55 kg person stands in an elevator accelerating upwards at 2.5 m/s^2.
    a. Draw a FBD of the forces acting on the person (normal and gravity)

    b. What is the net force acting on the person and in which direction? (Use Newton's 2nd law)

$$F_{net} = ma$$
$$= 55kg \times 2.5\frac{m}{s^2}$$
$$= 137.5\,N \text{ upwards} \approx 140\,N \text{ upwards}$$

    c. What is real weight (force of gravity) of the person? (Use $F_g = mg$)

$$F_g = mg = 55kg \times 9.8\frac{m}{s^2}$$
$$= 539\,N \approx 540\,N \text{ down}$$

    d. What is apparent weight (normal force) of the person?

Since they are accelerating upwards
Normal Force is winner

F_{net} = winners − losers

$$F_N = 137.5N + 539\,N = 676.5$$
$$\approx 680\,N$$

Force of Gravity (Weight) Practice Name:_____

14. An 85 kg person stands in an elevator accelerating downwards at 2.5 m/s^2.
    a. Draw a FBD of the forces acting on the person (normal and gravity)

    b. What is the net force acting on the person and in which direction? (Use Newton's 2nd law)

$$F_{net} = ma$$
$$= 88kg \times 2.5 m/s^2$$
$$= 220 N \text{ downwards}$$

    c. What is real weight (force of gravity) of the person? (Use $F_g = mg$)

$$F_g = mg$$
$$= 88 kg \times 9.8 \frac{m}{s^2}$$
$$= 862.4 N \text{ downwards} \approx 860 N$$

    d. What is apparent weight (normal force) of the person?

F_{net} = Winners − losers

Winning force is gravity

$$F_N = 862.4 - 220$$
$$= 642.4 N \approx 640 N$$

Force of Gravity (Weight) Practice Name:_____

15. A person stands in an elevator accelerating at 4.0 m/s^2 upwards. If they have a mass of 73 kg what will their apparent weight be? What will it appear their mass is?

$F_{net} = ma = 292\text{ N up}$

$F_g = mg = 715.4\text{ N down}$

$F_N = \text{Apparent weight} = 715.4 + 292$

$= 1007.4 \approx (1.0 \times 10^3\text{ N})$

Apparent mass

$F_g = mg$

$\frac{F_g}{g} = m$

$\frac{1007.4\text{ N}}{9.8\ \frac{m}{s^2}} = (1.0 \times 10^2\text{ kg})$

16. A person stands in an elevator acceleration at 1.50 m/s^2 downwards. If they have a mass of 64.0kg, what will their apparent weight be? What will it appear their mass is?

$F_{net} = ma = 96\text{ N down}$

$F_g = mg = 627.2\text{ down}$

$F_N = \text{Apparent Weight}$

$= 627.2 - 96$

$= 531.2 \approx (530\text{ N})$ ← 2 sig figs because we used 9.8 for g

Apparent mass

$\frac{F_g}{g} = m \quad \frac{531.2}{9.8} = (54\text{ kg})$

17. Standing on a scale you bend your knees and dip down to a crouch. Will the scale give a reading higher or lower than your actual mass?

Accelerating down so (lower)

18. From a crouch while standing on a scale you quickly stand up. Will the scale give a reading higher or lower than your actual mass?

Accelerating up so (higher)

Force of Gravity (Weight) Practice Name:_____

19. A person gets into an elevator, the elevator accelerates upwards until it is moving at its max speed, continues at that speed for a while and then slows to a stop at the person's floor. Describe how the apparent weight of the person changes throughout the ride.

Accelerating up : apparent weight increases

Constant velocity : apparent weight = weight

Slowing (Accelerating downwards) : apparent weight decreases

20. An astronaut is in a rocket accelerating upwards at 49 m/s^2. How many time greater than their real weight is their apparent weight?

Pretend their mass is 1 kg

Real weight = mg = 9.8 N

Apparent weight:

$F_{net} = mg$

$= 49$ N

$F_N = 49 + 9.8$

$= 58.8$ N

Apparent weight is

$\frac{58.8}{9.8} = 6.0$ times greater than real weight