

CONCEPT: WEIGHT FORCE AND GRAVITATIONAL ACCELERATION

- All objects near Earth are affected by **gravity**. Gravity produces a **Force**, which produces an **acceleration**. (_____)

- **GRAVITY**

- Conceptual phenomena which says that objects with mass attract each other



- **FORCE** due to Gravity (a.k.a. _____)

$$\underline{\hspace{1cm}} = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

UNITS: _____

- Always points towards Earth's center (usually pointing down)



- **ACCELERATION** due to GRAVITY (a.k.a. Gravitational Acceleration)

$$\underline{\hspace{1cm}} = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

(near Earth)

UNITS: _____

- NOT constant, varies by location: For example, $g_{\text{Earth}} = \underline{\hspace{1cm}}$, $g_{\text{Moon}} = \underline{\hspace{1cm}}$

- The term “**WEIGHT**” is used incorrectly in everyday language.

- Scales don't measure **WEIGHT**. Instead, they measure _____.

- Mass [____] = Quantity of matter, [**DOES** | **DOESN'T**] change at different locations

- Weight [____] = Force due to gravity, [**DOES** | **DOESN'T**] change at different locations (just like ____)

EXAMPLE: You step on a bathroom scale and it measures your “weight” to be 70kg. What is your REAL weight on Earth's surface?

EXAMPLE: If an object has mass 10kg on the Earth, what is its mass on the Moon? What is its weight on the Earth? What is its weight on the Moon if $g_{\text{moon}} = 1.62 \text{ m/s}^2$?

PROBLEM: The Mars Rover Perseverance weighed about 10,000 N while on Earth. After it reached the surface of Mars, it weighed about 3790 N. What is the gravitational acceleration on Mars?

- A)** $g_{\text{Mars}} = 0.039 \text{ m/s}^2$
- B)** $g_{\text{Mars}} = 0.27 \text{ m/s}^2$
- C)** $g_{\text{Mars}} = 3.7 \text{ m/s}^2$
- D)** $g_{\text{Mars}} = 26 \text{ m/s}^2$

CONCEPT: VERTICAL FORCES AND ACCELERATION IN THE Y-AXIS

- You'll need to solve problems where vertical forces cause objects to accelerate in the Y-axis.

FORCES

- 1) Draw FBD: W, F_A, T, N, f
- 2) Write $\Sigma F = ma$
- 3) Solve

EXAMPLE: A 5.1 kg block is in the air, being pulled vertically by a (massless) string. Find the block's acceleration for each of the following Tension forces.

a) $T = 70\text{N}$

- If $|F_{\text{up}}| \quad |F_{\text{down}}| \Rightarrow a = [\text{positive} \mid \text{negative} \mid 0 \mid -g]$

c) $T = 50\text{N}$

- If $|F_{\text{up}}| \quad |F_{\text{down}}| \Rightarrow a = [\text{positive} \mid \text{negative} \mid 0 \mid -g]$

b) $T = 30\text{N}$

- If $|F_{\text{up}}| \quad |F_{\text{down}}| \Rightarrow a = [\text{positive} \mid \text{negative} \mid 0 \mid -g]$

d) $T = 0\text{N}$

- If $|F_{\text{up}}| \quad \Rightarrow a = [\text{positive} \mid \text{negative} \mid 0 \mid -g]$

(Assuming no other forces)

PROBLEM: A 3-kg bucket is being pulled upwards by a cord. The tension in the cord is 35 N. What is the acceleration of the bucket? (The mass of the cord is negligible, which means you can assume $m_{cord} = 0$.)

- A) 25 m/s^2
- B) 1.9 m/s^2
- C) 21 m/s^2
- D) 8.4 m/s^2

FORCES
1) Draw FBD: $\mathbf{W, F_A, T, N, f}$
2) Write $\Sigma \mathbf{F} = m\mathbf{a}$
3) Solve

PROBLEM: A 100-kg load of bricks is being lowered down on a cable at a speed of 5 m/s. If the load takes 2 s to slow from that speed to a stop, what is the tension in the supporting cable during that time interval?

- A) 1230 N
- B) 730 N
- C) 1480 N
- D) 980 N

FORCES
1) Draw FBD: $\mathbf{W, F_A, T, N, f}$
2) Write $\Sigma \mathbf{F} = m\mathbf{a}$
3) Solve