

## Forces Worksheet

1. Complete the following table about the properties of the four fundamental forces:

Property	Fundamental Force
Acts between charged particles	electromagnetic
Acts in the nucleus	strong / weak
Has the shortest range of all the forces	weak
Has unlimited range	electromagnetic / gravitational
The weakest force	gravitational
Acts between protons	strong / electromagnetic / gravitational
Due to the fact that objects have mass	gravitational
Can be attractive or repulsive	electromagnetic
Is only attractive	strong / weak / gravitational

2. Identify to which of the four fundamental forces each of the following belongs:

Force	Category
Weight	gravitational
Spring pulling a book	electromagnetic
Occurs between neutrons	strong nuclear
Occurs between particles smaller than protons	weak nuclear
Allows a balloon to stick to a wall	electromagnetic
Friction	electromagnetic
Bat hitting a ball	electromagnetic

- Why is it particularly dangerous to drive on an icy highway?
- Why do you lunge forward when your car suddenly comes to a halt? Why are you "thrown backward" when your car rapidly accelerates?
- Why is your body pressed against the left side of the seat when the car you are riding in suddenly veers to the right?

- ③ less friction means you require more distance when stopping.
- ④ inertia; in the first situation, your tendency is to continue moving in a straight line when your car stops; in the second situation, your tendency is to stay at rest when your car starts moving.
- ⑤ the car turns, but you continue in a straight line which causes you to lean into the door/seat.
- ⑥ it resists or slows the motion
- ⑦ it stays constant
- ⑧ both
- ⑨ none, once it is moving it will keep moving forever since there are no forces acting on it ( $\Sigma F = 0$ )
- ⑩ due to its larger mass, the elephant has a harder time changing direction. This would slow it down as it tried to zig-zag after you.

⑪

$$\begin{aligned} \vec{F}_g &= mg \\ &= (2)(9.8) \\ F_g &= \boxed{19.6 \text{ N}} \end{aligned}$$

⑫

$$\begin{aligned} \Sigma F &= \vec{F}_1 + \vec{F}_2 && \leftarrow \text{vector addition} \\ &= 10 + 15 \\ \Sigma F &= \boxed{25 \text{ N}} \end{aligned}$$

$$\textcircled{13} \quad \Sigma F = F_1 + F_2 \quad \leftarrow \text{vector addition}$$

$$= 10 + (-15)$$

$$\Sigma F = -5 \text{ N}$$

or

$\boxed{5 \text{ N}}$  in the direction of the 15 N force

$$\textcircled{14} \quad F_g = mg$$

$$= (50)(9.8)$$

$$F_g = \boxed{490 \text{ N}}$$

$$\textcircled{15} \quad F_g = mg$$

$$300 = m(9.8)$$

$$m = \frac{300}{9.8}$$

$$m = \boxed{30.6 \text{ Kg}}$$