Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must:
1. *Draw a picture or diagram* to visualize the problem
2. *Show each step of your calculations clearly*
3. *Write a few sentences* explaining important steps and discussing the reasonableness of your result.
It is ok to collaborate with your peers, but the work must be your own.
*You must take assignments seriously to learn physics*

1. A 35-kg child is climbing a rope to get to a tree fort. What is the tension in the rope if
   i. the child is climbing the rope at a constant speed?
   ii. the child is accelerating up the rope at 3 m/s²?
   iii. the child is resting on the rope?
   iv. the child is resting on the rope, but the rope is attached to a crane and accelerated upward at 3 m/s²?

2. What average force is needed to accelerate a 7.00-gram pellet from rest to 125 m/s over a distance of 0.800 m along the barrel of a rifle?

3. A freight train has a mass of 1.5×10^{7} kg. If the locomotive can exert a constant pull of 7.5×10^{5} N, how long does it take to increase the speed of the train from rest to 80 km/h?

4. Two horizontal forces, $\vec{F}_1$ and $\vec{F}_2$, are acting on a box, but only $\vec{F}_1$ is shown in the drawing. $\vec{F}_2$ can point either to the right or to the left. The box moves only along the x axis. There is no friction between the box and the surface. Suppose that $\vec{F}_1$ = +9.0 N and the mass of the box is 3.0 kg. Find the magnitude and direction of $\vec{F}_2$ when the acceleration of the box is
   i. +5.0 m/s²
   ii. -5.0 m/s²
   iii. 0.0 m/s²
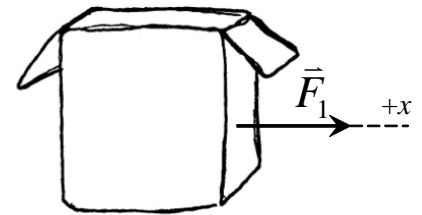
Questions 5 & 6:
A 5 kg block rests on a flat plane inclined at an angle of 30 degrees to the horizon as shown in the diagram below.
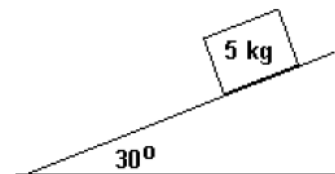
5. (MC) What would be the acceleration of the block down the plane assuming the force of friction is negligible?
   (A) 0.5 m/s²
   (B) 0.87 m/s²
   (C) 5 m/s²
   (D) 8.7 m/s²
   (E) 10 m/s²

6. (MC) If the block is placed on a second plane (where friction is significant) inclined at the same angle, it will begin to accelerate at 2.0 m/s. What is the force of friction between the block and the second inclined plane?
   (A) 10 N
   (B) 15 N
   (C) 25 N
   (D) 43.3 N
   (E) 50 N

"You don't have to be a fantastic hero to do certain things. You can be just an ordinary chap, sufficiently motivated to reach challenging goals."
- Sir Edmund Hillary