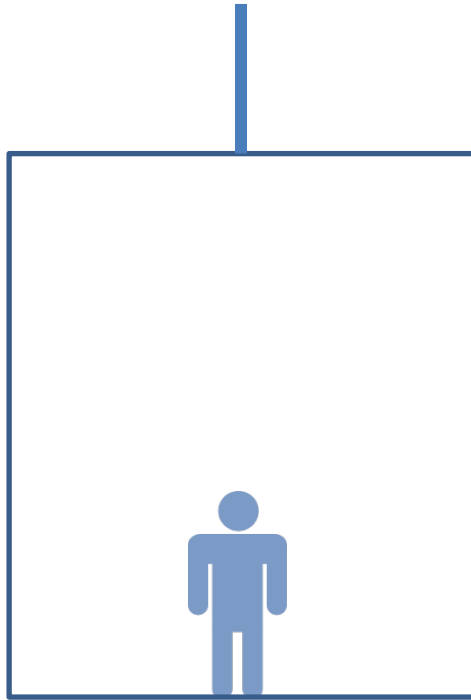


1. An elevator with an initial velocity of  $5 \text{ ms}^{-1}$  in an upwards direction and comes to rest uniformly in 2 seconds. The elevator has a mass of 1000 kg and the man inside has a mass of 100 kg.



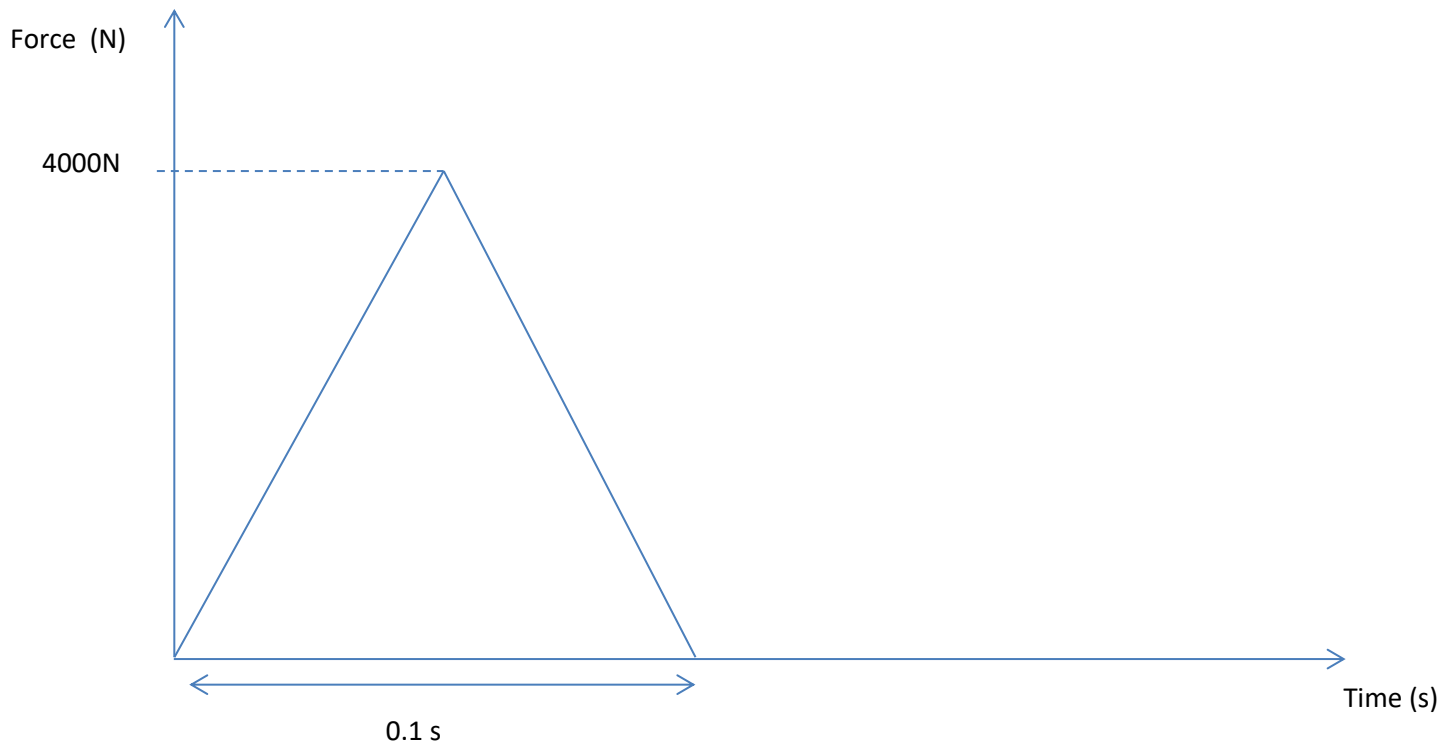
(a) Determine the acceleration of the elevator (2 marks)

(b) Draw and label the forces acting on the man in the elevator. **Show the relative sizes of all force vectors** (3 marks)



(c) State the magnitude and direction of the force the man exerts on the elevator. (3 marks)

2. A 50 kg girl is standing on a force plate. She jumps into the air in a vertical direction. The graph below shows the force from the plate acting on her feet.

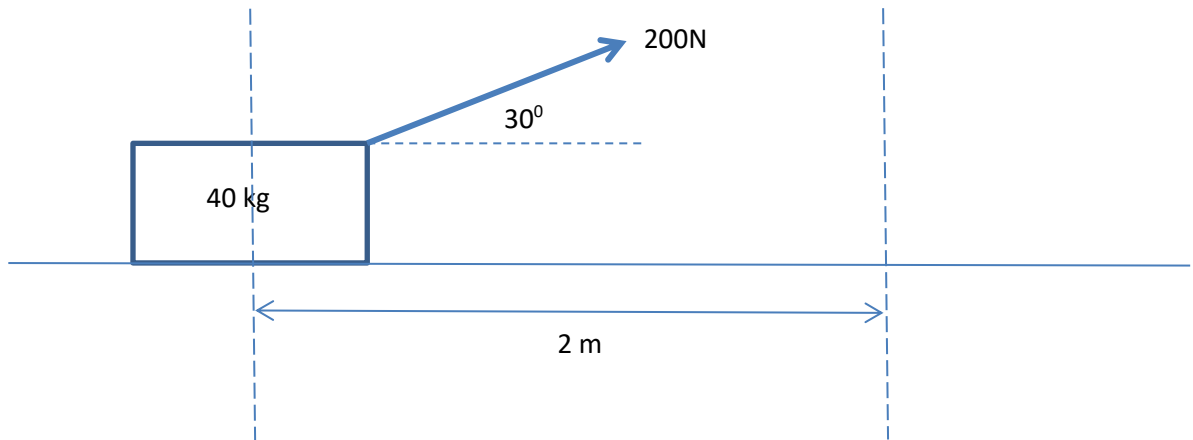


(a) Determine the change in her momentum as a result of jumping off the plate. ( 2marks)

(b) How high does she jump relative to the force plate ( 4 marks)

( c ) What is her rate of change in momentum while she is in the air? ( 2 marks)

3. A mass is being pulled across a frictionless table as shown below.



(a) What is the change in kinetic energy of the mass in moving across 2m? ( 2 marks)

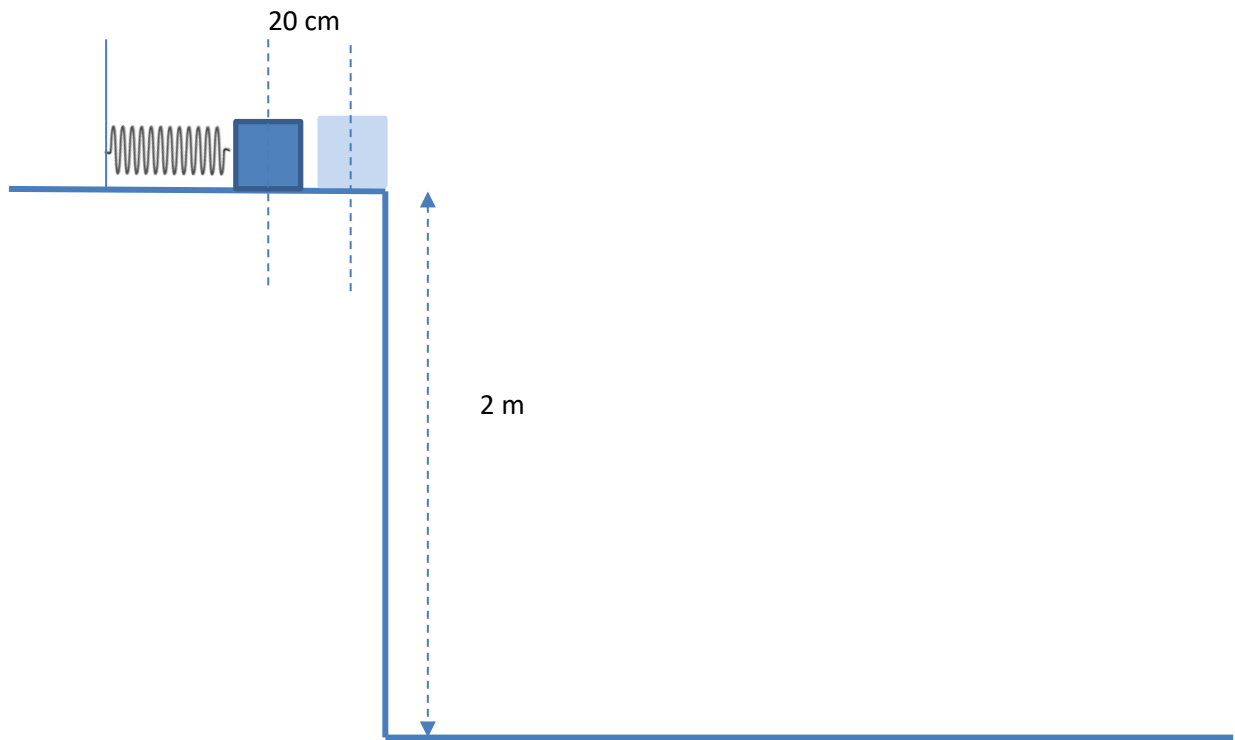
Consider now moving the same block with the same force across a surface of kinetic friction 0.2

(b) What force of friction acts on the mass ( 2 marks)

(c) What would be the change in kinetic energy if the surface had a coefficient of kinetic friction of 0.2 (3 marks)

(c) Explain why the change in kinetic energy calculated in (a) and (c) are different. ( 1mark)

4. A 50 gram mass is placed against a spring with a spring constant of  $100\text{Nm}^{-1}$  as shown below. The spring + mass is displaced 20cm and released. The mass is allowed to project off a frictionless surface over a vertical height of 2 m.



- (a) Determine the impact speed of the mass. ( 3 marks)
- (b) Explain how the horizontal displacement of the mass would change if the spring were displaced by 40 cm. ( 3 marks)
5. A car drives up a ramp inclined at  $30^\circ$  to the horizontal with a constant power of  $100\text{kW}$  and speed of  $20\text{ ms}^{-1}$ . The mass of the car is  $500\text{kg}$ .
- (a) What force of friction is opposing the motion of the car? (2 marks)
- (b) At what rate is mechanical energy being lost in this system ( 2 marks)