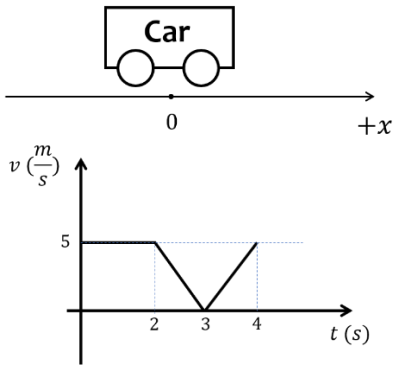
PHYS 204 – Mechanics
Practice Midterm
75 minutes

Multiple Choice

1. **(5 marks)** Alice, who weighs 500 N is standing on a scale inside an elevator that is going up with constant speed of 5 m/s. The reading of the scale in the elevator is (take $g = 10\frac{m}{s^2}$):
   a) 750 N
   b) 500 N
   c) 250 N
   d) 1000 N

2. **(5 marks)** The figure describes the velocity of a car moving in one dimension as a function of time. What is the displacement and average acceleration of the car during 4 seconds? The dotted lines are to guide the eye.
   a) $\Delta\vec{x} = 10\ m$ and $\vec{a} = 0$
   b) $\Delta\vec{x} = 0$ and $\vec{a} = 1.25\frac{m}{s^2}$
   c) $\Delta\vec{x} = -15\ m$ and $\vec{a} = 1.25\frac{m}{s^2}$
   d) $\Delta\vec{x} = 15\ m$ and $\vec{a} = 0$

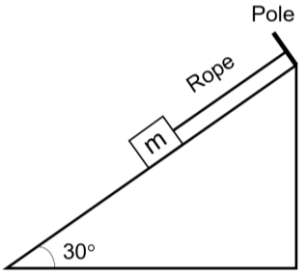


3. **(5 marks)** To hold a 1-kg block against a vertical wall, a <u>minimum</u> horizontal force of 20 N is required. What is the coefficient of static friction? (take $g = 10\frac{m}{s^2}$)
   a) $\mu_s = 0.1$
   b) $\mu_s = 0.5$
   c) $\mu_s = 0.3$
   d) The block will slide down due to the gravitational force

4. **(5 marks)** Bob is driving with constant speed in a curved path with radius $r = 50\ m$. If the coefficient of static friction between his tires and the road is 0.5, with what <u>approximate maximum speed</u> can he drive without skidding? Round your answer. Take $g = 10\frac{m}{s^2}$.
   a) 12 m/s

b) 16 m/s
c) 14 m/s
d) 20 m/s

5. **(5 marks)** A 2-kg block is connected to a rope that is tied to a pole on an inclined surface, as shown below. If the coefficient of static friction is 0.3, find the tension in the rope. Take $g = 10\frac{m}{s^2}$.

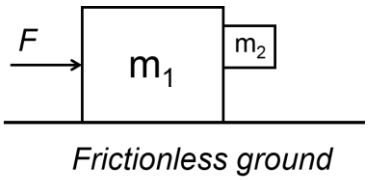


a) 6.4 N
b) 10.2 N
c) 0
d) 4.8 N

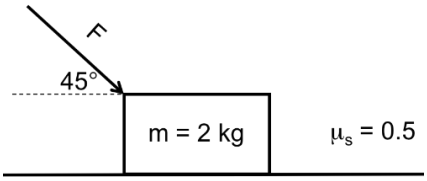
Long Answer

Instruction:
You MUST submit your detailed solution written on a white sheet of paper, through COLE.

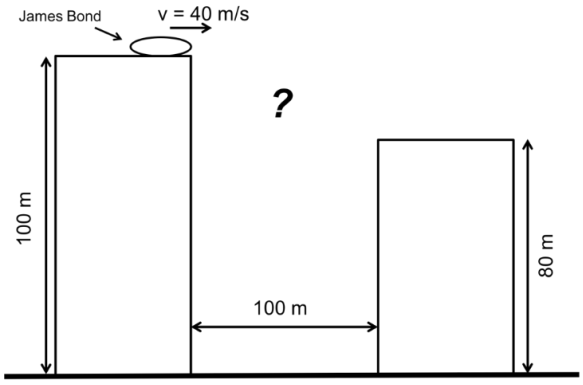
6. **(15 marks)** In the system shown in the figure, $m_1 = 1\ kg$ and $m_2 = 3\ kg$ (regardless of the dimension of the boxes in the figure). What should be the minimum force F, such that mass m_2 does not slide down (remains stationary with respect to mass m_1)? The coefficient of static friction between the boxes is $\mu_s = 0.5$ and there is no friction between m_1 and the ground. Draw the free body diagram. Show your detailed work.



7. **(15 marks)** As shown in the figure, a force F is applied to a box with mass m = 2kg at angle of 45° with the horizon. If the coefficient of static friction is $\mu_s = 0.5$, find the range of force F (F_{min}, F_{max}), for which the object remains stationary. Draw the free body diagram. Show your detailed work.



8. James Bond is driving his Aston Martin with speed of 40 m/s as he flies off a 100 m tall building, hoping to land on an 80 m tall building that is 100 m away (see the figure below). Show your detailed work. Take $g = 10\,\frac{m}{s^2}$.



   a) **(7 marks)** Determine the coordinates (x and y) of his landing point (or crashing point on the building!).
   b) **(8 marks)** What is his velocity when he lands (or crashes)?