Physics I

## Set no. 4

Please assume that $g = 10$ m/s^2 (magnitude the acceleration due to gravity) unless otherwise stated

1. A newton is the force (please choose):
   A) of gravity on a 1 kg body
   B) of gravity on a 1 g body
   C) that gives a 1 g body an acceleration of 1 cm/s^2
   D) that gives a 1 kg body an acceleration of 1 m/s^2
   E) that gives a 1 kg body an acceleration of 9.8 m/s^2

2. A force of 1 N is (please choose):
   A) 1 kg/s   B) 1kg $\times$ m/s   C) 1kg $\times$ m/s^2 D) 1kg $\times$ m^2/s   E) 1kg $\times$ m^2/s^2

3. The term "mass" refers to the same physical concept as (please choose):
   A) weight   B) inertia   C) force   D) acceleration   E) volume

(E) 4. The block shown moves with constant velocity on a horizontal surface. Two of the forces on it are shown. A frictional force exerted by the surface is the only other horizontal force on the block. Please calculate the frictional force.

$F_1 = 5N$
$F_2 = 3N$
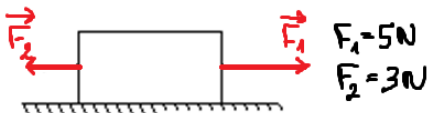
5. A 6-kg object is moving south with speed 8 m/s. A net force of 12 N north on it result in the object having an acceleration. Please determine the direction of the acceleration and calculate the time after which the object will stop.

(E) 6. Please calculate the system acceleration and the tension forces between m_1 and m_2 and between m_2 and m_3 . Please assume there is no friction.
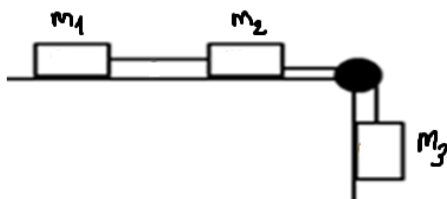

(E) 7. Two forces $\mathbf{F_1}$ ($F_1 = 10$ N) and $\mathbf{F_2}$ ($F_2 = 6$ N) act on the block (m = 2 kg), resting at t = 0. Static and kinetic friction coefficients are μ_s =0.4 and μ_s = 0.1, respectively. Please calculate the acceleration of the block in the following cases: a) when the forces are in the same direction, b) when the forces are in opposite directions.

(E) 8. Please find the acceleration of the body slides down the slope with angle α.

   a) Assume the body slides without friction

b) Assume that the block slides with friction (friction coefficient μ)
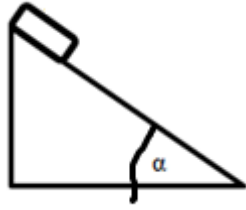
9. A heavy wooden block is dragged by a force **F** along a rough steel plate, as shown below for two cases. The magnitude of the applied force is the same for both cases. Please find a ratio between the normal force (the force exerted by the block on the ground)in (ii) and in (i)

(i)   (ii)
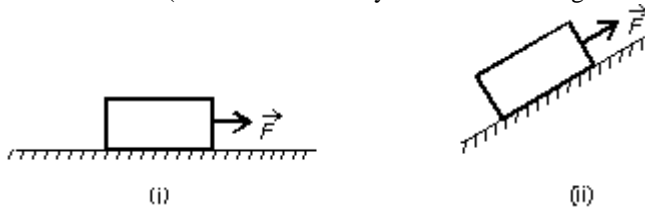
10. Please count the height to which the body will reach when moving under a road constructed of two sections: a horizontal path with a length of s_1 and a friction coefficient f_1 and an inclined angle and friction coefficient f_2. At the beginning the body has the speed v.
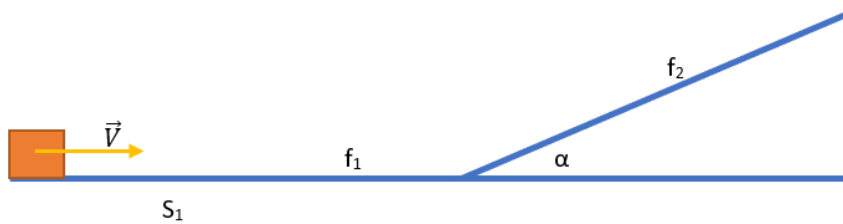
11. A 1000-kg elevator is rising and its speed is increasing at 3 m/s^2. Please find the tension force in the elevator cable.

12. A man is standing in an elevator
a) going up with acceleration of $a = 0.25\ g$;
b) going down with acceleration of $a = 0.25\ g$;
c) going up or down with constant velocity of $v = 2$ m/s.

Please find the value of the force that the floor of the elevator acts on the man.

13. A force of 5 N in the x direction and 2 N in the z direction is applied to a body of m = 1 kg. At the initial moment the body rested at the point $\vec{r}$(t=0) = [1,2,1]. Please write the equations of motion using Newton's II dynamic rule (vector and for each coordinate separately) and find $\vec{r}$ (t).

14. Please write equations of motion and find $\vec{r}(t)$.for a particle with mass m and charge q, in a homogeneous (uniform) electric field $(\vec{F}=q\vec{E})$ $\vec{E} = [0, E_0, 0]$. Please accept initial conditions $\vec{r}(t=0) = [0,0,0]$, $\vec{V}(t=0)=[V_{ox}, V_{oy},0]$

(E) 15. Let us assume that the road is a curve with a radius R = 60 m and is inclined at a certain angle α to the ground. Please determine this angle so that cars can negotiate the curve at a speed of v = 12 m/s even when the road is icy (no friction).
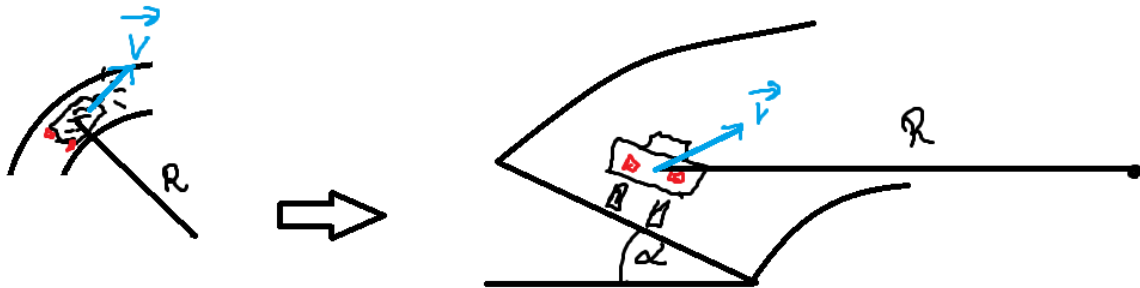
(E) 16. A particle is moving with a constant speed along a circle shown below. At point P(-4 m, 0 m) the velocity of the particle is v_P = -8 m/s $\mathbf{j}$. Please find acceleration and velocity vectors at point S.
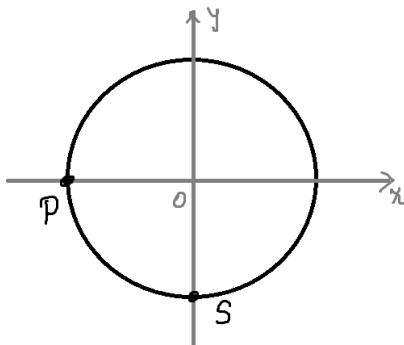
(E) 17. The system shown below is in the rest. Let us assume that a = 6 m, b = 8 m, m_1 = 20 kg, m_2 = 30 kg. Please find the friction force and the minimal value of friction coefficient between m_1 and the slope.