

Instructions: You have a total of 50 minutes to complete this test.

Answer each question completely showing complete details.

For complete credit you must include correct SI units with numerical answers.

Time Start _____ Time finish _____ pledged _____

Constants: $g = 9.8 \frac{\text{m}}{\text{s}^2}$

(1) A particle is observed to move with a constant acceleration given by:

$$\vec{a} = 0\hat{x} - et^3\hat{y}$$

where the constant e has SI units of $[e] = \left[\frac{\text{m}}{\text{s}^5} \right]$.

(a) Find the velocity **vector** at a later time assuming that at $t=0$ the initial velocity vector is zero.

(b) Find the position **vector** at a later time assuming that at $t=0$, the velocity and position vectors are both zero.

Suppose another particle is seen to have a position vector given by:

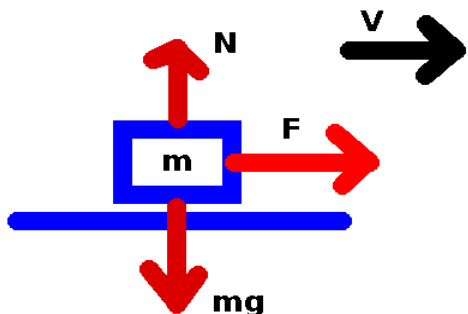
$$\vec{R}(t) = (v_{0,x}t)\hat{x} + (v_{0,y}t - kt^6)\hat{y}$$

The constant k has SI units of $[k] = \left[\frac{\text{m}}{\text{s}^5} \right]$.

(c) Find the velocity **vector** at a later time.

(d) Find the acceleration **vector** at some later time.

- (2) A mass is resting on a table and a force F is as shown. There is a kinetic coefficient of friction between the mass and the table of μ . You may assume F is large enough to accelerate the mass and that the mass is given a theoretical push so that it is moving.



- (a) On the diagram below, sketch and label the frictional force, f .
- (b) In the box above, draw a complete and correct free body diagram for this system.
- (c) Provide the 2 equations that come from Newton's Laws for this system and the frictional force. You will have 3 equations total here.
- (d) Solve for the frictional force in terms of μ , m and g .
- (e) Find the acceleration of the system **in terms of m , F , μ and g** .
- (f) Find the velocity of the mass at a time t **in terms of m , F , μ and g** . You may assume the initial velocity here is zero.
- (g) If $M=1\text{kg}$, $F=3\text{N}$, $\mu=0.2$ and $t=5\text{ s}$, then provide numerical answers for a and v **together with correct SI units**.

$a =$ _____

$v =$ _____

September 9, 2020	Physics 240: UnTest 1	Name: _____
-------------------	-----------------------	-------------

(3) A ball is thrown upward at an angle of 35° with respect to the horizontal direction with an initial velocity of 10 m/s. Answer the following questions, **providing correct SI units**.

(a) How long is the ball in the air?

(b) What is the maximum height to which the ball rises?

(c) What is the impact velocity **vector** of the ball?

(d) What is the range of the ball?

(4) Consider the following vectors:

$$\vec{A} = 3\hat{x} - 1\hat{y} : \vec{B} = -3\hat{x} + 4\hat{y} : \vec{C} = 5\hat{x} - 6\hat{y}$$

(a) $\vec{A} - \vec{C} =$ _____

(b) $\vec{C} \cdot \vec{B} =$ _____

(c) $|\vec{A} + \vec{C}| =$ _____

(d) $\vec{C} \cdot \hat{x} =$ _____