PHYS 21800 PRACTICE EXAM 1

Part I – Multiple Choice Questions [2 pts each]

Directions: Circle the one alternative that best completes the statement or answers the question. Unless otherwise stated, assume ideal conditions (no air resistance, uniform gravity, etc.)

1) Which of the following quantities is a *vector*?
(A) mass

(B) speed

(C) weight

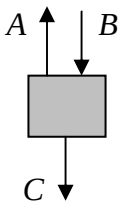
(D) distance

2) Three forces of magnitudes *A*, *B*, *C* act on an object that is accelerating *upward*. The net force acting on the object equals
(A) zero

(B) $A - B - C$

(C) $A + B - C$

(D) $A + B + C$



3) A bug travels one complete lap around a square of side 0.10 m. The magnitude of the bug's *total displacement* equals
(A) zero

(B) 0.10 m

(C) 0.20 m

(D) 0.40 m

4) An astronaut stands on the surface of the Moon. Which statement is *true*?
(A) Her mass on the Moon is greater than her mass on Earth.

(B) Her weight on the Moon is greater than her weight on Earth.

(C) Her mass on the Moon equals her mass on Earth.

(D) Her weight on the Moon equals her weight on Earth.

5) At the instant that a rifle is fired, the bullet experiences a force of magnitude F_1 from rifle, while the rifle experiences a force of magnitude F_2 from the bullet. What is the relationship between F_1 and F_2?
(A) $F_1 = F_2$

(B) $F_1 > F_2$

(C) $F_1 < F_2$

(D) not enough info

6) A guy walks 5.00 miles at 30° south of west. The *x* component of his displacement equals
(A) –2.50 miles

(B) 2.50 miles

(C) –4.33 miles

(D) 4.33 miles

7) Which force drags against the motion of any object as it slides along a surface?
(A) normal

(B) kinetic friction

(C) weight

(D) static friction

8) Which statement is *true* for any object that falls in a vacuum close to the surface of the Earth?
(A) The object moves at constant velocity.

(B) The net force acting on the object equals zero.

(C) The object falls 9.8 meters each second.

(D) The object speeds up by 9.8 m/s each second.

9) Which quantity measures an object's resistance to acceleration?
(A) force

(B) velocity

(C) coefficient of friction

(D) mass

10) Projectile motion consists of constant _____ vertically and constant _____ horizontally.
(A) acceleration, velocity

(B) acceleration, acceleration

(C) velocity, acceleration

(D) velocity, velocity

Formulas and Constants

$F_{net} = ma$ $\quad w = mg$ $\quad f = \mu n$ $\quad F_{grav} = \dfrac{Gm_1m_2}{r^2}$

$s_{av} = \dfrac{d}{t}$ $\quad v_{av} = \dfrac{\Delta x}{t}$ $\quad a_{av} = \dfrac{\Delta v}{t}$ $\quad G = 6.67\times10^{-11}\ \text{N}\cdot\text{m}^2/\text{kg}^2$

$\Delta x = v_i t + \frac{1}{2}at^2$ $\quad v_f = v_i + at$ $\quad \Delta x = \frac{1}{2}(v_i + v_f)t$ $\quad v_f^2 = v_i^2 + 2a\Delta x$

$v_{fy} = v_{iy} - gt$ $\quad \Delta y = v_{iy}t - \frac{1}{2}gt^2$ $\quad \Delta x = v_{ix}t$ $\quad g = 9.8\ \text{m/s}^2$

Part II – Word Problems [20 pts each]

Directions: Show your work to receive full credit. Box your final answer and record its appropriate unit.

Problem 1

A hiker walks 4.00 km at northwest, then 5.00 km at 25° west of south, and then 7.00 km at 35° south of east. Calculate

(A) the magnitude of the hiker's total displacement.

(B) the direction (angle) of the hiker's total displacement. *Be sure to indicate this angle clearly in a diagram!*

Problem 2

A point particle moves along the x axis in the following way:

I. It starts from rest at $x = 0$ and accelerates at 3.00 m/s^2 from $x = 0$ to $x = 200$ m.

II. It then moves with a constant velocity from $x = 200$ m to $x = 500$ m.

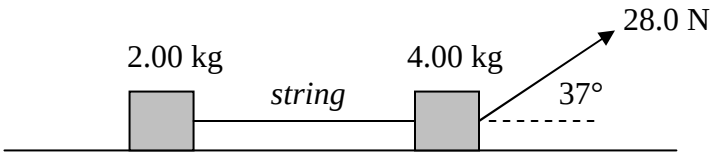
Calculate

(A) the time it takes the particle to travel from $x = 0$ to $x = 200$ m.

(B) the particle's velocity at $x = 200$ m.

(C) the time it takes the particle to travel from $x = 200$ m to $x = 500$ m.

Problem 3



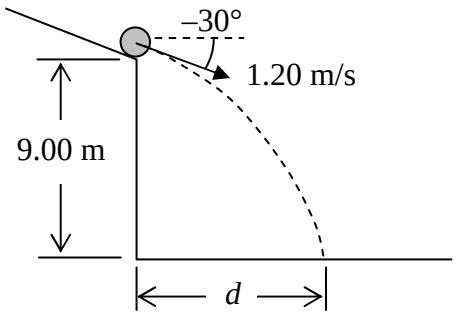
A 2.00-kg block and a 4.00-kg block, connected by a light string, sit on a horizontal surface. The coefficient of kinetic friction between the 2.00-kg block and the surface equals 0.64. *There is no friction between the 4.00-kg block and the surface*. The 4.00-kg block experiences a force of 28.0 N at 37°, causing the system to accelerate to the right. Calculate

(A) the magnitude of the kinetic friction acting on the 2.00-kg block.

(B) the acceleration of the system.

(C) the tension in the string.

Problem 4



A ball rolls off a roof with an initial velocity of 1.20 m/s at an angle of –30°. The ball leaves the roof at a height of 9.00 m and strikes the ground a distance *d* from the base of the house. Calculate
(A) the time it takes the ball to reach the ground.
(B) the distance *d*.
(C) the magnitude of the ball's velocity as it strikes the ground.