PHYS 2050: FIRST PRACTICE EXAMINATION

Campus/Centre:	( ) Downtown campus (x) Loa Campus

Examination Days:	**TBD**	**Examination Dates:**	**TBD**
Examination Time:	**TBD**	**Duration:**	**75 min**

Course Abbreviation & Number:	**PHYS 2050**
Course Title:	**General Physics I**

Name of Student: _____

Student Number: _____

INSTRUCTIONS TO CANDIDATES

1. This examination consists of 5 pages.
2. There are 8 conceptual and 8 quantitative questions in this examination.
3. **All working must be shown.**
4. **Units must be shown.**
5. A list of selected formulae is provided below.

LIST OF SELECTED FORMULAE

Kinematics equations

$$v_x = \frac{dx}{dt}$$
$$a_x = \frac{dv_x}{dt}$$

Quadratic equation

For $ax^2 + bx + c = 0$

$$x = \frac{-b}{2a} \pm \frac{1}{2a}\sqrt{b^2 - 4ac}$$

Calculus formulas for power laws

$$\frac{d}{dx}(Ax^n) = Anx^{n-1}$$
$$\int_{x_0}^{x} Ax'^n\, dx' = \frac{A}{n+1}x'^{n+1}\Big|_{x_0}^{x}$$

Newton's 2nd law

$$\sum \vec{F} = m\vec{a}$$

Kinematics equations for **constant** acceleration

$$v = v_0 + at$$
$$x = x_0 + v_0 t + \tfrac{1}{2}at^2$$
$$v^2 = v_0^2 + 2a(x - x_0)$$
$$\bar{v} = \frac{v + v_0}{2}$$

Some vector properties

$$\vec{A}\cdot\vec{B} = AB\cos\theta$$
$$\left|\vec{A}\times\vec{B}\right| = AB\sin\theta$$
$$\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$$

Friction model

$$F_k = \mu_k N$$
$$F_s \le \mu_s N$$

Newton's 3rd law

$$\vec{F}_{1\text{ on }2} = -\vec{F}_{2\text{ on }1}$$

Conservation of energy

$$\Delta K + \sum \Delta U_i = W_{\text{ext}}$$

Cartesian coordinate cross product

$$\vec{A}\times\vec{B} = \det\begin{bmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{bmatrix}$$

Gravitational potential energy

$$\Delta U_g = mg(y - y_0)$$

Kinetic energy

$$\Delta K = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

Work-kinetic energy theorem

$$W_{\text{net}} = \Delta K$$

Spring potential energy

$$\Delta U_s = \tfrac{1}{2}kx^2 - \tfrac{1}{2}kx_0^2 \quad \text{when} \quad x_{eq} = 0$$

Centripetal acceleration

$$a_{\text{rad}} = \frac{v^2}{r}$$

Work

$$W = \int \vec{F}\cdot d\vec{r}$$

Relative velocity

$$\vec{v}_{A/E} = \vec{v}_{A/B} + \vec{v}_{B/E}$$

Constant circular motion

$$v = \frac{2\pi r}{T}$$

Force from P.E.

$$F_x = -\frac{\partial U}{\partial x}$$

Power

$$P = \frac{dE}{dt}$$

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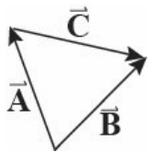
Conceptual Section (Circle the correct answer)

1. When adding two numbers, the number of significant figures in the sum is always [2]

   A. equal to the number of significant figures in the most accurate of the numbers being added.
   B. equal to the number of significant figures in the least accurate of the numbers being added.
   C. equal to the sum of both sets of significant figures.
   D. equal to the number of significant figures of the number with the most zeros.

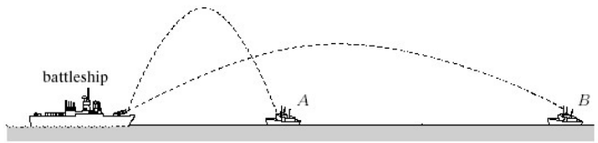
2. In the diagram, which one is correct? [2]



   A. $\vec{C} = \vec{A} - \vec{B}$
   B. $\vec{C} = \vec{A} + \vec{B}$
   C. $\vec{C} = \vec{B} - \vec{A}$
   D. Choices A and B

3. A battleship simultaneously fires two shells at enemy ships. Which ship gets hit first? [2]

   A. Ship A.
   B. Ship B.
   C. Both at the same time.
   D. Not enough information.



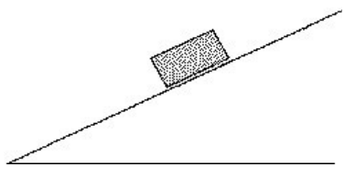
4. A cart is being pushed up a hill at constant velocity by three people. The net force on the car is [2]

   A. up the hill and greater than the weight of the car.
   B. down the hill and greater than the weight of the car.
   C. up the hill and equal to the weight of the car.
   D. zero.

5. An object at any given time may have [2]

   A. only kinetic or potential energy.
   B. only kinetic energy.
   C. kinetic energy, potential energy, and internal energy.
   D. kinetic energy, potential energy, eccentric energy.

6. A brick is resting on a rough incline as shown in the figure. The friction force acting on the brick, along the incline, is [2]

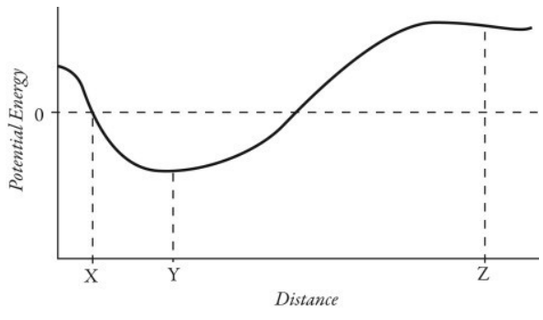


   A. zero.
   B. equal to the weight of the brick.
   C. less than the weight of the brick.
   D. greater than the weight of the brick.

7. If the net work done on an object is positive, what can you conclude about the object's motion? [2]

   A. The object is at rest; its position is constant.
   B. The object is slowing down.
   C. The object is speeding up.
   D. The object is moving with a constant velocity.

8. The plot in the figure shows the potential energy of a particle, due to the force exerted on it by another particle, as a function of distance. At which of the three points labeled in the figure is the magnitude of the force on the particle greatest? [2]



   A. Point X.
   B. Point Y.
   C. Point Z.
   D. All points have the same force.

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Quantitative Section

1. The acceleration of a particle traveling along the *x*-axis is given by

$$a(t) = (3.00\ m/s^2) - (1.00\ m/s^3)t$$

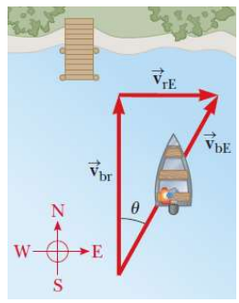
(a) Write an expression for the velocity as a function of time given that the initial velocity v_0 is 1.00 m/s when $t = 0$. [3]

(b) Write an expression for the position as a function of time given that the particles initial position x_0 is 10.0 m at $t = 0$. [3]

(c) Determine the maximum velocity of the particle. [4]

2. There are three dimensionless vectors $\vec{A} = \hat{\imath} + 2\hat{k}$, $\vec{B} = 3\hat{\imath} - \hat{k}$, and $\vec{C} = -2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$. Calculate the value of $(\vec{A} \times \vec{B}) \cdot \vec{C}$. [4]

3. A boat crossing a wide river moves with a speed of v_{br} = 10.0 m/s relative to the water as shown in the diagram. The water in the river has a uniform speed of v_{rE} = 5.00 m/s due east relative to the Earth.



(a) If the boat heads due north, determine the magnitude of the velocity, v_{bE}, for the boat relative to an observer standing on either bank. [3]

(b) What is the angle θ, that describes the boat's actual travel direction relative to the straight path across the river? [3]

4. A projectile is shot from the edge of a cliff an unknown height h above the ground with an initial speed of 68.0 m/s at an angle of 35.0° with the horizontal as shown in the figure. The projectile impacted the ground a distance 550 m from the base of the cliff.

   (a) Fill in the blanks with numerical answers.

   (i) The horizontal component of the projectile's initial velocity is _____m/s. [1]

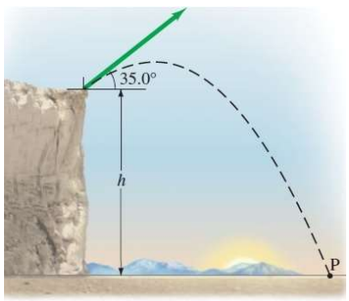
   (ii) The vertical component of the projectile's initial velocity is _____m/s. [1]

   (iii) The horizontal component of the projectile's acceleration is _____m/s^2. [1]

   (iv) The vertical component of the projectile's acceleration is _____m/s^2. [1]

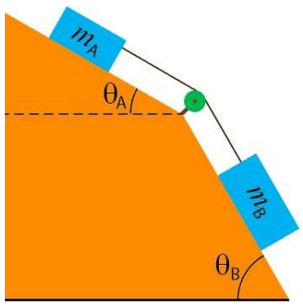
   (b) Determine the time it took the projectile to reach this range. [3]

   (c) Determine the height of the cliff. [4]



5. Two blocks of mass m_A =1.00 kg and m_B = 1.80 kg are connected to each other by a string run over a massless pulley as shown in the diagram. Each block lies on a frictionless surface. The two inclines make angles of $\theta_A = 30.0°$ and $\theta_B = 60.0°$ with respect to the horizontal.

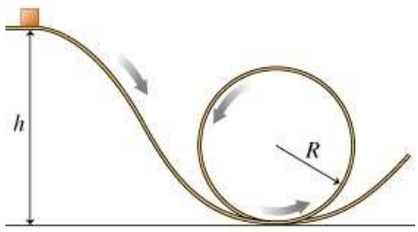
   (a) Draw two free body diagrams, one for each block. [4]



   (b) Determine the magnitude of the acceleration of the system. [4]

   (c) Determine the magnitude of the tension in the rope. [4]

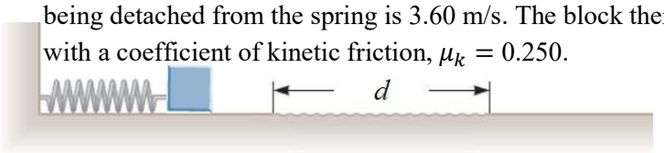
6. A block of mass $m = 1.50$ kg, starting from rest, is released at a height $h = 13.0$ m above the ground and slides along a frictionless track. The car encounters a loop of radius $R = 4.00$ m.



(a) Determine the speed of the car at the top of the loop. [4]

(b) Determine the magnitude of the normal force acting on the block at the top of the loop. [4]

7. A block of mass $m = 0.35$ kg is forced against a stiff horizontal spring of negligible mass on a smooth horizontal surface. The spring is initially compressed a distance of 5.00 cm from its equilibrium position. The block accelerates after being released and detaches from the spring at the equilibrium position. Its speed after being detached from the spring is 3.60 m/s. The block then reaches a patch of friction of length d = 50.0 cm with a coefficient of kinetic friction, $\mu_k = 0.250$.



(a) Determine the spring constant k. [4]

(b) Determine the final speed after the block crosses the patch of friction. [4]

8. The instantaneous power is a known function of time, $P = (3.50\ \mathrm{J/s^2})t + (3.50\ \mathrm{J/s^3})t^2$. There is zero work done on the system at $t = 0$. Determine the work done at $t = 2.50$ s. [4]

END OF EXAMINATION