HAWAI'I PACIFIC UNIVERSITY

PHYS 2050: FIRST PRACTICE EXAMINATION

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

Examination Day:	**N/A**	**Examination Date:**	**N/A**
Examination Time:	**N/A**	**Duration:**	**2 h**

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

Name of Student: ______________________________

Student Number: ______________________________

INSTRUCTIONS TO CANDIDATES

1. This examination consists of 7 pages.
2. There are 15 conceptual and 8 quantitative questions in this examination. Answer ALL questions.
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

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

Newton's 3rd law

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

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

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

Friction model

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

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

$$\Delta U_s = \frac{1}{2}k(x - x_{eq})^2 - \frac{1}{2}k(x_0 - x_{eq})^2$$

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.

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

Course Abbreviation & Number:	**PHYS 2050**	**Semester:**	**N/A**
Course Title:	**General Physics I**		
Examination Date:	**N/A**	**Duration:**	**2 h**

<u>Conceptual Section</u> (Circle the correct answer)

1. Under what condition is $|\vec{A} - \vec{B}| = A + B$? [2]

   A. Vectors $\vec{A}$ and $\vec{B}$ are in perpendicular directions.
   B. Vectors $\vec{A}$ and $\vec{B}$ are in the same direction.
   C. Vectors $\vec{A}$ and $\vec{B}$ are in opposite directions.
   D. The statement is never true.

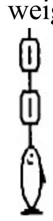
2. The area under a velocity vs. time graph of an object traveling in one-dimension is [2]

   A. the displacement of the object
   B. the object's acceleration at that point.
   C. the distance traveled by the object.
   D. the object's speed at that point.

3. If an object travels at a constant speed in a circular path, the acceleration of the object is [2]

   A. zero.
   B. larger in magnitude the smaller the radius of the circle.
   C. in the opposite direction of the velocity of the object.
   D. smaller in magnitude the smaller the radius of the circle.

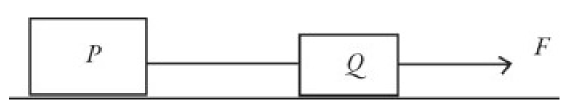
4. A fish weighing 16 N is weighed using two spring scales, each of negligible weight, as shown in the figure. What will be the readings of the scales? [2]

   A. Each scale will read 16 N.
   B. Each scale will read 8 N.
   C. The bottom scale will read 16 N, and the top scale will read zero.
   D. The top scale will read 16 N, and the bottom scale will read zero.

5. Two bodies *P* and *Q* on a smooth horizontal surface are connected by a light cord. The mass of *P* is greater than that of *Q*. A horizontal force of magnitude *F* is applied to *Q* as shown, accelerating the bodies to the right. The magnitude of the force exerted by the connecting cord on body *P* will be [2]

   A. equal to *F*.
   B. less than *F* but not zero.
   C. greater than *F*.
   D. zero.

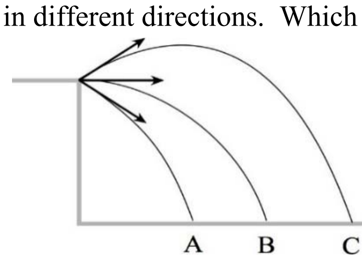
   

6. A box slides down a frictionless plane inclined at an angle θ, above the horizontal. The gravitational force on the box is directed [2]

   A. perpendicular to the plane.
   B. parallel to the plane in the opposite direction as the movement of the box.
   C. at an angle θ, below the inclined plane.
   D. vertically downwards.

7. Three balls are thrown off a cliff with the same speed, but in different directions. Which ball has the greatest speed just before it hits the ground? [2]

   A. Ball A.
   B. Ball B.
   C. Ball C.
   D. All balls have the same final speed.

8. If you raise an object to a greater height at constant velocity, you are increasing the [2]

   A. kinetic energy.
   B. heat.
   C. chemical energy.
   D. potential energy.

Course Abbreviation & Number:	PHYS 2050	Semester:	N/A
Course Title:	General Physics I		
Examination Date:	N/A	Duration:	2 h

Quantitative Section

1. The acceleration of a motorcycle is given by $a_x(t) = At - Bt^2$. The motorcycle is at rest at the origin at time $t = 0$.

(a) Find its velocity as a function of time. [3]

(b) Find its position as a function of time. [3]

(c) Calculate the maximum velocity it attains when $A = 1.50\ \mathrm{m}/s^3$ and $B = 0.120\ \mathrm{m}/s^4$. [2]

2. Let vectors $\vec{A} = \hat{\imath} - 3\hat{k}$, $\vec{B} = -2\hat{\imath} + 5\hat{\jmath} + \hat{k}$, and $\vec{C} = 3\hat{\imath} + \hat{\jmath} + \hat{k}$.

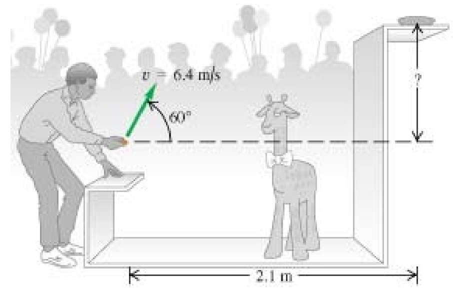
(a) Determine $\vec{B} \times \vec{C}$. [2]

(b) Determine $\vec{C} \times \vec{B}$. [2]

(c) Determine $\vec{A} \cdot (\vec{B} \times \vec{C})$. [3]

3. A stunt pilot of mass 47.0 kg who has been diving her airplane vertically pulls out of the dive by changing her course to a circle in a vertical plane. If the plane's speed at the bottom of the circle is 94.8 m/s, what is the minimum radius of the circle for the acceleration at this point not to exceed four times the gravitational acceleration, g? [3]

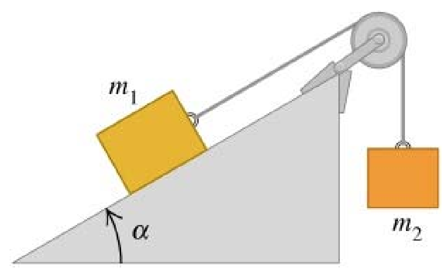
4. In a carnival booth, you win a stuffed giraffe if you toss a quarter into a small dish. The dish is on a shelf above the point where the quarter leaves your hand and is a horizontal distance of 2.1 m from this point. If you toss the coin with a velocity of 6.4 m/s at an angle of 60º above the horizontal, the coin lands in the dish. You can ignore air resistance.



(a) How long does it take for the quarter to land in the dish? [3]

(b) What is the height of the shelf above the point where the quarter leaves your hand? [2]

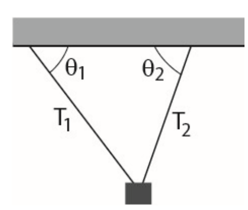
5. A block with mass m_1 = 4.00 kg is placed on an inclined plane with slope angle α = 25º and is connected to a second hanging block that has mass m_2 by a cord passing over a small, frictionless pulley. The coefficient of static friction is μ_s = 0.40 and the coefficient of kinetic friction is μ_k = 0.34.



(a) Draw two free body diagrams, one for each block. [2]

(b) Find the mass m_2 for which block m_1 moves up the plane at constant speed once it has been set in motion. [3]

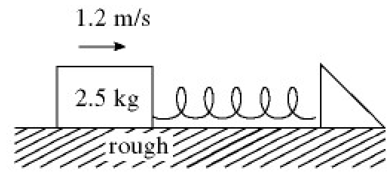
6. A 10.0 kg block hangs from the ceiling by two massless strings. The first string makes an angle θ_1=50.0º with the ceiling and the second string makes an angle θ_2=65.0º with the ceiling.



(a) Draw a free body diagram and determine the magnitude of the tension in the first string, $|\vec{T}_1|$. [3]

(b) Determine the magnitude of the tension in the second string, $|\vec{T}_2|$. [2]

7. A 2.5 kg box, sliding on a rough horizontal surface, has a speed of 1.2 m/s when it makes contact with a spring (see the figure). The block comes to a momentary halt when the compression of the spring is 5.0 cm. The work done by the friction, from the instant the block makes contact with the spring until is comes to a momentary halt, is -0.50 J.

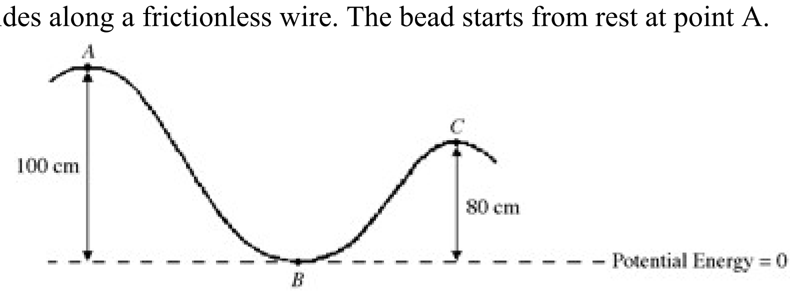


   (a) What is the spring constant of the spring? [3]

   (b) What is the coefficient of kinetic friction between the box and the rough surface? [2]

8. A force along the *x*-direction acts on a particle moving along the *x*-axis. This force produces potential energy $U(x) = (1.20\ \text{J/m}^4)\ x^4$. What is the force (magnitude and direction) when the particle is at $x = -0.800$ m. [3]

9. A 0.250 kg bead slides along a frictionless wire. The bead starts from rest at point A.



   (a) What is the potential energy of the bead at point A with respect to the ground? [1]

   (b) What is the kinetic energy of the bead at point B? [2]

   (c) What is the speed of the bead at point C? [2]

END OF EXAMINATION