Kuwait University

Department of Physics

(A)

PHYS 101 **First Mid-Term Examination**

General Physics 1

Date : April 15, 2009 **Time:12:30- 1:55 PM**

Student's Name:_____**KU ID**:_____Section:___

Instructor's Name:_____

INSTRUCTIONS:

- Do not start until you are told to do so.
- Solve all problems, show all work and circle your final answer.
- Show all work neatly in this booklet.
- Books and notes are not permitted.
- Make sure that exam booklet includes 4conceptual questions and 6 problems, in 4 pages including the cover page.
- Mobile phones and pagers are not allowed during the exam time.
- Circle your final answer.
- Take g = 10 m/s^2

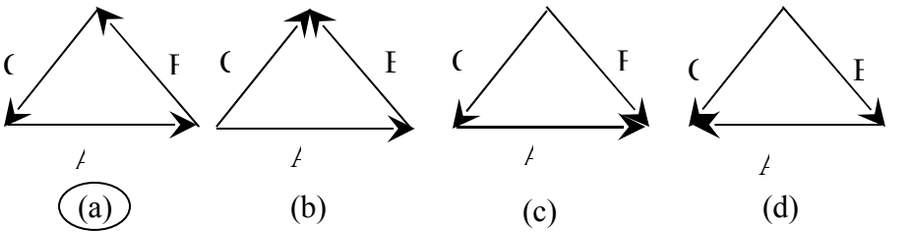
For Instructors only:

Prob.	1	2	3	4	5	6	Subtotal
Score							

MCQ	1	2	3	4	Subtotal
Score					

Part I: Questions (Choose the correct answer)

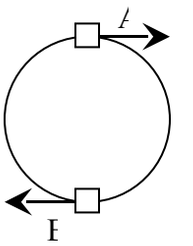
1. A, B and C are three vectors of equal magnitude . Which one of the following figures verify the relation. $A + B + C = 0$



(a) (b) (c) (d)

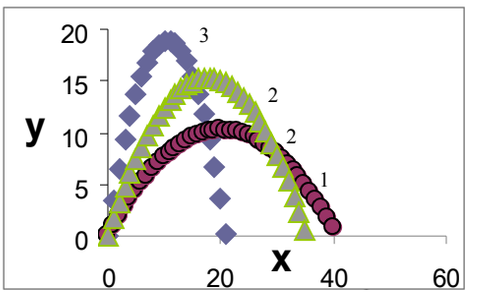
2. A Ferris wheel rotates uniformly so that all point on its rim move with the same linear speed v . What is the velocity of passenger B as measured by passenger A ?

i) zero
ii) V
iii) –V
iv) -2V



3.Three balls (1,2 ,3) are thrown from the same point with the same initial speed but with angles 45°, 60° ,75° respectively (see figure). The ball that has the longest time of flight is

i) Ball 3
ii) Ball 2
iii) Ball 1
iv) All the same



4. If the velocity of a particle at all times is given by $v = \left(3\hat{i} + 3\hat{j}\right)\ m/s$ then the path of the particle is:

i) circular with radius 3 m
ii) projectile path
iii) curved path
iv) straight line

Part II: Problems (solve the following problems)

1. A, B and C are three vectors.

   $A = 3i + 4j$

   $B = 4i + 3j - 2k$

   $C = 3i - 4j$

   Find the product $(3A \wedge 2C) \bullet 4B$

$$D = A \times C = -12\hat{k} - 12\hat{k} = -24\hat{k}$$

$$\vec{D} \bullet \vec{B} = -24(-2) = 48$$

$$(3\vec{A} \times 2\vec{C}) \cdot 4\vec{B} = 24(48) = 1152$$

2. A particle is projected with initial velocity of $(30\hat{i} + 40\hat{j})$ m/s. Find its range (in m).

$$R = \frac{2v_{ox}\, v_{oy}}{g}$$

$$R = \frac{2(30)(40)}{10} = 240\, m$$

3. A particle is thrown vertically upward from the roof of a building 50 high. It strikes the ground 5 seconds later. Find its maximum height above the ground (in m).

$$\Delta y = v_o t - \frac{1}{2} g t^2$$

$$-50 = v_o(5) - \frac{1}{2}(10)(5)^2$$

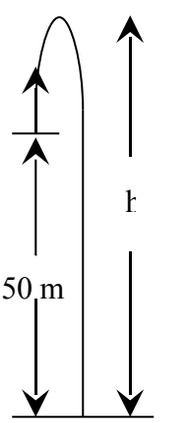
$$v_o = 15\, m/s$$

$$v^2 = v_o^2 - 2g\Delta y$$

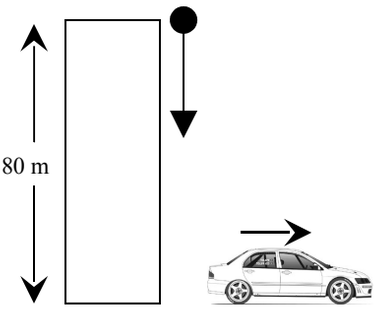
$$0 = (15)^2 - 2(10)\Delta y$$

$$\Delta y = 11.25\, m$$

$$h = 11.25 + 50 = 61.25\, m$$



4. A package is released from the top of a 80-meters high building . In the same time, a car is moving in a direction normal to the building with constant speed of 20 m/s (see figure). Find the magnitude of the velocity of the package relative to the car at the instant the package reaches the ground



$$v_{PG}^2 = v_o^2 - 2g\Delta y$$

$$v_{PG}^2 = 0 - 2(10)(-80)$$

$$|\vec{v}_{PG}| = 40 m/s$$

$$\vec{v}_{PG} = -40\hat{j}, \vec{v}_{CG} = 20\hat{i}$$

$$\vec{v}_{PG} = \vec{v}_{PC} + \vec{v}_{CG} \Rightarrow \vec{v}_{PC} = -20\hat{i} - 40\hat{j}$$

$$v_{PC} = \sqrt{(20)^2 + (40)^2} = 44.7 m/s$$

5 A Ferris wheel of radius R = 30 m rotates uniformly about an axis perpendicular to its plane through its center. How many rpm (rev/min) must it make so that the acceleration of a passengers at the rim is 5 m/s^2?

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$$a = \frac{v^2}{R} \Rightarrow v = \sqrt{5(30)} = 12.24 m/s$$

$$v = \frac{2\pi R}{T} \Rightarrow T = \frac{2(3.14)(30)}{12.24} = 15.4 s$$

$$T = \frac{t}{N} \Rightarrow N = \frac{60}{15.4} = 3.9 rpm$$

6. A man runs in a linear track. His position varies with time according to

$x(t) = 4 + 2t - 2t^2$

Where x is in meters and t is in seconds. Find his average speed (in m/s) during the first 2 seconds.

$$v = \frac{dx}{xt} = 2.4t = 0 \Rightarrow t = 0.5 S$$

$t = 0, \quad x_1 = 4m$

$t = 0.5s, \quad x_2 = 4 + 2(0.5) - 2(0.5)^2 = 4.5 m$

$t = 2s \quad x_3 = 4 + 2(2) - 2(2)^2 = 0$

$d = 0.5(2) + 4 = 5m$

$$s = \frac{d}{t} = \frac{5}{2} = 2.5 m/s$$