Kuwait University
Physics Department

Version I

Physics 101

First Midterm Exam
Autumn Semester
Sunday, October 24, 2004
12:30 p.m. – 1:45 p.m.

Student's Name: .....

Student's Number: .....

Choose your Instructor's Name :

Prof. Fekri El-Akkad.
Dr. Ahmed Ali Al-Jassar
Dr. Abdulnasser Burezq
Dr. Abdel Muhsen Habib
Dr. Hala Khalid Al-Jassar

Dr. Afifa Bahbehani
Dr. Adnan Al-Yaseen
Dr. Yaccob Makdisi
Dr. Majed Ali Fehmi
Dr. Tariq Ramadan

Grades	Q1	Q2	Q3	P1	P2	P3	P4	P5	P6	Total
Points	e 1	c 1	d 1	b 2	d 2	e 2	a 2	a 2	e 2	15

Important Notes:

1. Answer all questions and problems.
2. Each question will be assigned 1 points.
3. Each problem will be assigned 2 points.
4. No solution for problems = no points.
5. Check the correct answer for each question and problem.
6. Take $g = 10\ m/s^2$
7. Mobiles and Pagers are not allowed during the exam.
8. Programmable calculators which can store equations are not allowed.

GOOD LUCK

Part I Choose the Correct Answer:

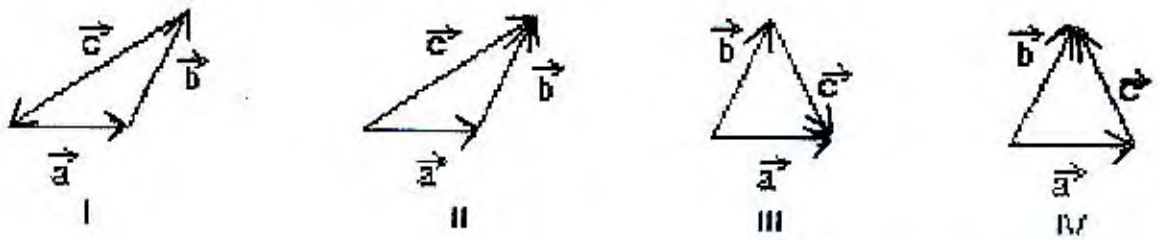
1. Four particles move along the x-axis are presented in the following equations. Which of these particles is/are decelerating (i.e. speed is decreasing) between $t_1 = 0$ to $t_2 = 1$ (s):

a) A b) B c) C d) A and B e) A and D f) B and C

Particle A : $x(t) = 27\,t - 4\,t^3$
Particle B : $x(t) = 27 - 4\,t^3$
Particle C : $x(t) = 27 + 4\,t^3$
Particle D : $x(t) = 50\,t - 5\,t^3$

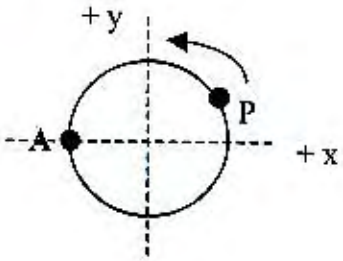
2. If $\mathbf{c} = \mathbf{a} - \mathbf{b}$, which of the following vector diagram illustrates this relationship:

a) I b) II c) III d) IV e) I and II f) I and III



3. A particle P is moving in a circle of radius r, with constant speed v. The velocity v (in m/s) and the radial acceleration a (in m/s^2) of the particle at point A are:

a) $\mathbf{v} = v\mathbf{i}$ and $\mathbf{a} = (v^2/r)\,\mathbf{i}$
b) $\mathbf{v} = -v\mathbf{i}$ and $\mathbf{a} = -(v^2/r)\,\mathbf{j}$
c) $\mathbf{v} = -v\mathbf{j}$ and $\mathbf{a} = (v^2/r)\,\mathbf{j}$
d) $\mathbf{v} = -v\mathbf{j}$ and $\mathbf{a} = (v^2/r)\,\mathbf{i}$
e) $\mathbf{v} = v\mathbf{j}$ and $\mathbf{a} = (v^2/r)\,\mathbf{j}$
f) $\mathbf{v} = v\mathbf{j}$ and $\mathbf{a} = 0$



Part II Solve the Following Problems:
(Solution should be given explicitly for each problem)

1. The position of a particle moving along the x-axis is given in meter by $x(t) = 6t^2 - t^3$, where t is in seconds. The position (in m) of the particle when it achieves its maximum speed in the positive x direction is:

a) 2 b) 16 c) 24 d) 12 e) 32 f) Other

$x = 6t^2 - t^3$

$v = 12t - 3t^2$ when $v \to$ max.

$a = 0$

$a = 12 - 6t = 0$

$\Rightarrow t = 2$ (S)

$\therefore x(t=2) = 6(2)^2 - (2)^3 = 24 - 8 = \boxed{16}$ m

2. A balloon is moving downward with a constant velocity 8 m/s. A man drops a stone from the balloon at a height of 1000m from ground level. After 10 seconds, the (a) stone's height and (b) balloon's height, from ground are (in m):

a) (1200, 600) b) (1420, 1080) c) (420, 80)
d) (420, 920) e) (-580, -80) f) Other

$\Delta y = v_0 t - \frac{1}{2} g t^2 = -8(10) - \frac{1}{2}(10)(10)^2 = -580$

$\therefore$ stone's height $= 1000 - 580 =$ **420 m**

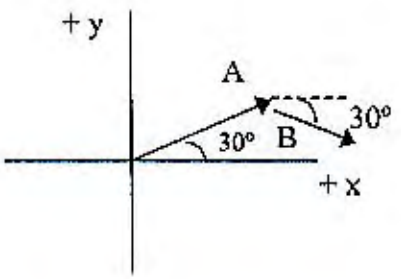
Balloon's speed is constant

$\rightarrow \Delta y = vt = -8(10) = -80$ m

$\therefore$ Balloon's height $= 1000 - 80 =$ **920 m**

3. In the diagram, vector **A** has magnitude 8 and vector **B** has magnitude 6. The y component of the vector (**A** – 2**B**) is:

a) 4 b) 7 c) 1 d) - 2 e) 10 f) Other



$A_y = 8 \sin 30^\circ = 4$

$B_y = 6 \sin(-30^\circ) = -3$

$A_y - 2B_y = 4 - 2(-3)$

$= 4 + 6 =$ **10**

4. A particle starts from the origin (0,0) with a velocity $\mathbf{v_0} = 2\mathbf{i}$ m/s and moves with acceleration $\mathbf{a} = 3\mathbf{j}$ m/s^2. After 4 s, the position of the particle (x, y) (in m) will be at point:

a) (8, 24) b) (8, 6) c) (2, 6) d) (2, 12) e) (2, 3) f) Other

$\Delta \vec{r} = \vec{v}_0 t + \frac{1}{2} \vec{a} t^2$

$\Delta \vec{r} = (2\hat{i})(4) + \frac{1}{2}(3\hat{j})(4)^2$

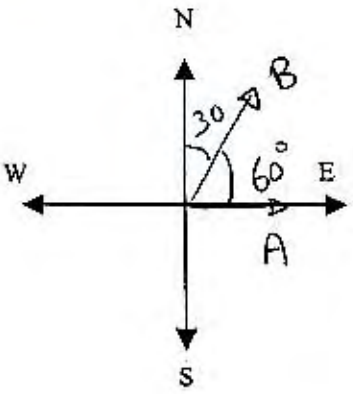
as $\vec{r}_0 \Rightarrow (0,0)$

$\vec{r} = 8\hat{i} + 24\hat{j}$

$\therefore x =$ **8** $y =$ **24**

5. A and B are two cars. Car A travels due east at 50 km/h relative to the ground. Car B travels 30° east of north at 100 km/h relative to the ground. The velocity (in km/h) of car A relative to car B is about:

a) -87 j b) 50 i c)) 50i + 87j d) 50i – 87j e) Zero f) Other



$$\vec{v}_{AG} = 50\hat{i}$$

$$\vec{v}_{BG} = 100\cos 60\hat{i} + 100\sin 60\hat{j}$$

$$\vec{v}_{BG} = 50\hat{i} + 86.6\hat{j}$$

$$\vec{v}_{AB} = \vec{v}_{AG} + \vec{v}_{GB}$$

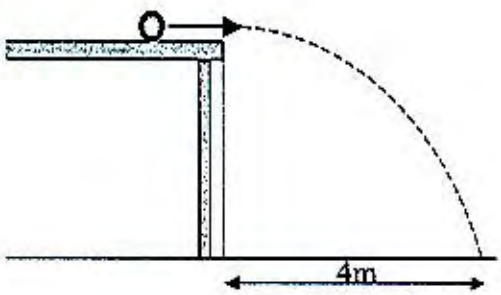
as $\vec{v}_{GB} = -\vec{v}_{BG}$

$$\vec{v}_{AB} = \vec{v}_{AG} - \vec{v}_{BG}$$

$$\simeq \boxed{-87\hat{j}} \text{ km/h}$$

6. A ball is thrown horizontally from the edge of a table with speed 8 m/s to fall 4 meters from the table. The speed (in m/s) of the ball just before it hits the ground is:

a) Zero b) 3.4 c) 5 d) 8 e) 9.4 f) Other



$v_o \longrightarrow$ constant in x-axis

$$\therefore t = \frac{x}{v} = 0.5 \text{ (s)}$$

$$v_y = v_{oy} - gt$$

$$= 0 - (10)(0.5) = -5 \text{ m/s}$$

$$v_y = \sqrt{8^2 + (-5)^2} = \sqrt{89} = \boxed{9.4 \text{ m/s}}$$