Kuwait University
Physics Department

Physics 101

First Midterm Exam
Spring Semester
Tuesday, March 29, 2005
12:30 p.m. – 1:45 p.m.

Student's Name: .... Key ....

Student's Number: ....

Choose your Instructor's Name :

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

Dr. Adnan Al-Yaseen
Dr. Yaccob Makdisi
Dr. Ismail Sabbah
Dr. Majed Ali Fehmi
Dr. Tarek Ramadan

Grades	Q1	Q2	Q3	Q4	P1	P2	P3	P4	P5	P6	Total
Points											

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.

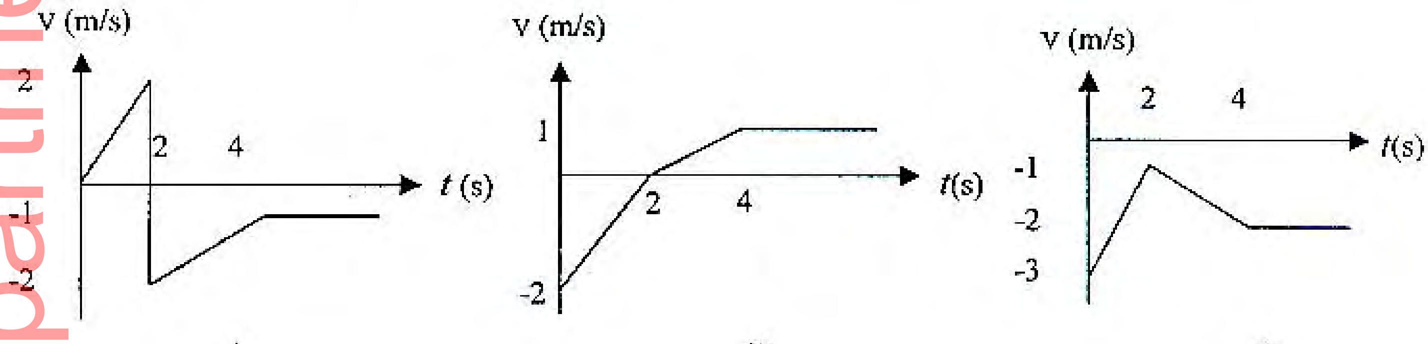
Part I: Questions *Choose the correct answer*

1. A ball is thrown upward from the ground level to a maximum height h and returns back to the ground level within a time of 4 s. The average velocity of the ball during that time is

(a) $-h/2$ (b) $-h/4$ (c) Zero (d) $h/4$ (e) $h/2$

2. A particle moves with an acceleration of $+1\ m/s^2$ in the first two seconds of motion, then the acceleration becomes $-0.5\ m/s^2$ for the next two seconds, and finally the particle moves with a constant speed. The velocity of the particle is described by

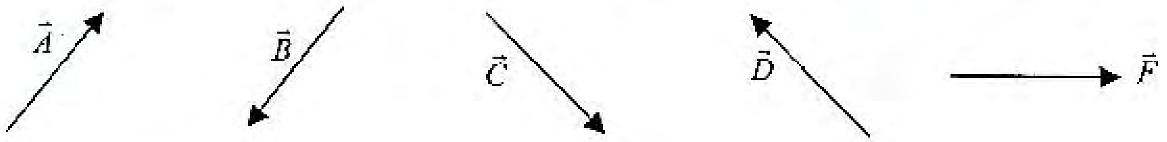
(a) A (b) B (c) C (d) A and B (e) All



A B C

3. The figures below show five different vectors $\vec{A}$, $\vec{B}$, $\vec{C}$, $\vec{D}$ and $\vec{F}$. The vectors that have negative dot product with the vector $\vec{F}$ are

(a) Only $\vec{A}$ (b) Only $\vec{C}$ (c) $\vec{A}$ and $\vec{C}$ (d) $\vec{B}$ and $\vec{D}$ (e) All



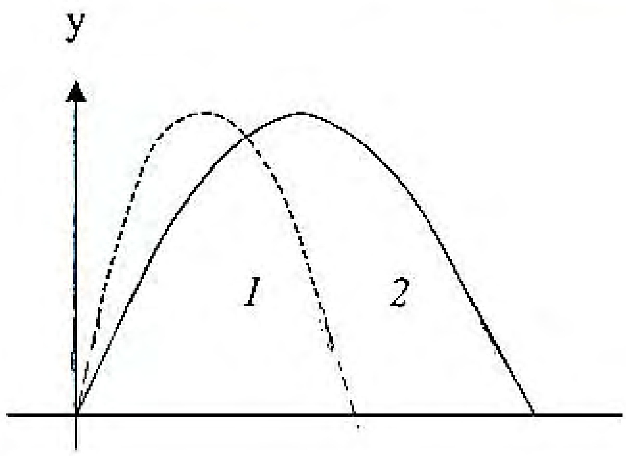
4. A ball is kicked from the ground level twice. If the graphs (1) and (2) show the paths for each kick, then

(a) $V_{oy1} > V_{oy2}$ and $V_{ox1} < V_{ox2}$

(b) $V_{oy1} < V_{oy2}$ and $V_{ox1} > V_{ox2}$

(c) $V_{oy1} = V_{oy2}$ and $V_{ox1} < V_{ox2}$

(d) $V_{oy_1} > V_{oy_2}$ and $V_{ox_1} > V_{ox_2}$



Part II: Problems ***Solve then choose the correct answer:***

1. A sport car traveling at a constant speed of 100 km/h passes a waiting police car which immediately starts to move from rest with a constant acceleration of 2.5 m/s^2. The speed of the police car when it catches the sport car is

(a) 300 km/h (b) 100 km/h (c) 200 km/h (d) 80 km/h (e) Other

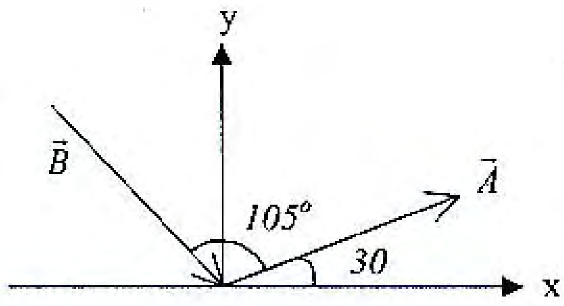
$\Delta x_1 = Vt \; , \quad \Delta x_2 = \frac{1}{2} a t^2$

$\Delta x_1 = \Delta x_2 \Longrightarrow Vt = \frac{1}{2} a t^2 \quad \therefore t = \frac{2V}{a}$

$\text{Speed} = at = a \cdot \frac{2V}{a} = 2V = 200\,\text{km/h}$

2. The two vectors $\vec{A}$ and $\vec{B}$ in the figure have equal magnitudes of 10.0 m. If the vector $\vec{S} = \vec{A} + \vec{B}$, then

(a) $\vec{S} = 6.1\hat{i} + 14.7\hat{j}$ (b) $\vec{S} = 15.7\hat{i} + 12.1\hat{j}$ (c) $\vec{S} = 1.59\hat{i} + 12.1\hat{j}$
(d) $\vec{S} = 15.7\hat{i} - 2.1\hat{j}$ (e) Other



$\vec{A} = 10 \cos 30^\circ \,\hat{i} + 10 \sin 30^\circ \,\hat{j}$

$\vec{B} = 10 \cos 45^\circ \,\hat{i} - 10 \sin 45^\circ \,\hat{j}$

$\vec{S} = 10 (\cos 30^\circ + \cos 45^\circ)\hat{i} + 10 (\sin 30^\circ - \sin 45^\circ)\hat{j}$

$\therefore \vec{S} = 15.7\,\hat{i} - 2.1\,\hat{j}$

3. The vectors $\vec{A} = 2\hat{i} + 3\hat{j} - 4\hat{k}$, $\vec{B} = -3\hat{i} + 4\hat{j}$, and $\vec{C} = 8\hat{i} + 6\hat{j}$. If the vector $\vec{D} = (\vec{A} \times \vec{B}) - 2\vec{C}$, then $\vec{D}$ is

(a) Normal to the x-y plane (b) Normal to the x-z plane (c) Parallel to the x-axis
(d) Parallel to the x-y plane (e) Other

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & -4 \\ -3 & 4 & 0 \end{vmatrix} = 16\hat{i} + 12\hat{j} + 17\hat{k}$$

$2\vec{C} = 16\hat{i} + 12\hat{j}$

$\vec{D} = (16\hat{i} + 12\hat{j} + 17\hat{k}) - (16\hat{i} + 12\hat{j}) = 0\hat{i} + 0\hat{j} + 17\hat{k}$

4. A man kicks a ball into the air with an initial speed V_o. After 0.2 s, the ball hits a building, 8m away, at a height of 5.8 m. Thus, the initial speed of the ball (in m/s) is

(a) 40 m/s (b) 50 m/s (c) 30 m/s (d) 49 m/s (e) Other

$$x - x_o = V_{ox} t \Rightarrow 8 = 0.2 V_{ox} \text{ or } V_{ox} = 40 \text{ m/s}$$

$$y - y_o = V_{oy} t - g t^2/2 \Rightarrow 5.8 = 0.2 V_{oy} - 5(0.2)^2 \Rightarrow V_{oy} = 30 \text{ m/s}$$

$$\therefore V_o = \sqrt{V_{ox}^2 + V_{oy}^2} = 50 \text{ m/s}$$

5. The moon rotates about the earth in approximately a circular path of radius R=385x10^6 m and requires 27.3 days (1 day = 86400 s) to make a complete revolution. The acceleration of the moon towards the earth (in m/s^2) is

(a) 20.4 m/s^2 (b) 2.7 x 10^{-3} m/s^2 (c) 10^{14} m/s^2 (d) 69 x 10^{-6} m/s^2 (e) Other

$$V = \frac{2\pi r}{T} = \frac{2\pi (385 \times 10^6)}{27.3 \times 86400} = 1025.57 \text{ m/s}$$

$$a = \frac{V^2}{r} = \frac{(1025.57)^2}{(385 \times 10^6)} = 2.7 \times 10^{-3} \text{ m/s}^2$$

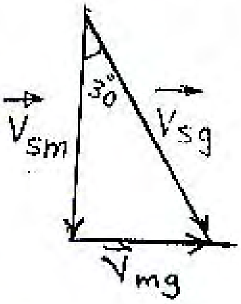
6. A man is driving a car in the east direction at a constant speed of 50 km/h. The man sees the snow falling vertically. If the snow is falling at an angle of 30° with the vertical towards the east, then the speed of the snow relative to the ground is

(a) 29 km/h (b) 58 km/h (c) 100 km/h (d) 87 km/h (e) Other

s ≡ snow, m ≡ man, and g ≡ ground

$$\vec{V}_{sg} = \vec{V}_{sm} + \vec{V}_{mg}, \quad \vec{V}_{sg} = V_{sg}(\sin 30^\circ \hat{i} - \cos 30^\circ \hat{j})$$

$$\vec{V}_{sm} = -V_{sm}\hat{j}, \text{ and } \vec{V}_{mg} = 50\hat{i} \text{ (km/h)}$$



$$\therefore V_{sg}\sin 30^\circ \hat{i} - V_{sg}\cos 30^\circ \hat{j} = 50\hat{i} \quad V_{sm}\hat{j}$$

$$\therefore V_{sg} = \frac{50}{(.5)} = 100 \text{ km/h} \quad \#$$

or use $\sin\theta = \frac{|\vec{V}_{mg}|}{|\vec{V}_{sg}|} \Rightarrow |\vec{V}_{sg}| = \frac{50}{.5} = 100$ km/h