Kuwait University

Department of Physics

PHYS 101 **Second Mid Term Examination** **General Physics 1**

Date : August 8, 2009 **Time: 9.00- 10.30 AM**

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

Instructor's : Drs. Ashraf Zaher, Adnan Yasin, Fatemah Al-Dousari,
Hala Al-Jassar and Tareq Al-Refai

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 5 conceptual questions and 10 problems, in 6 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 1: *Choose the right answer*

1. A block of mass m is rested on a table. The reaction of the force of gravity on the book is the force exerted by:

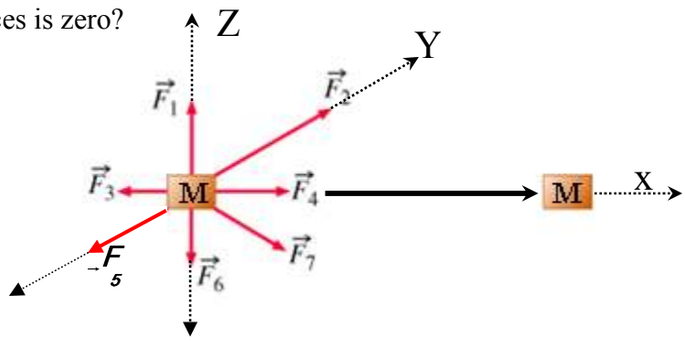
   (a.) Book on the earth
   b. Book on the table
   c. Table on the book
   d. Earth on the book

2. A block of mass m is placed on an inclined plane. The plane angle is increased gradually, then reduce the angle to keep the motion with constant speed. When the inclination angle is θ. The coefficient of friction μ_k is:

   a. zero
   (b.) tanθ
   c. sinθ
   d. cosθ

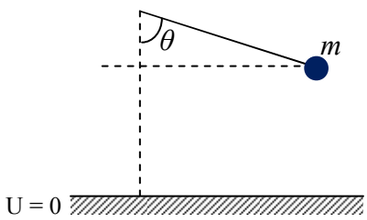
3. If an object of mass M undergoes displacement while being acted by a several forces as shown in the figure below. The work-done by which forces is zero?

   (a.) F_1, F_2, F_5, and F_6
   b. F_3 only
   c. F_7 only
   d. F_3 and F_7 only



4. A pendulum has mass m and length L. It released as shown in the figure below. The maximum potential energy for the given angles is:

   a. $\theta = 0$
   b. $\theta = 30$
   c. $\theta = 45$
   (d.) $\theta = 60$



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d. zero

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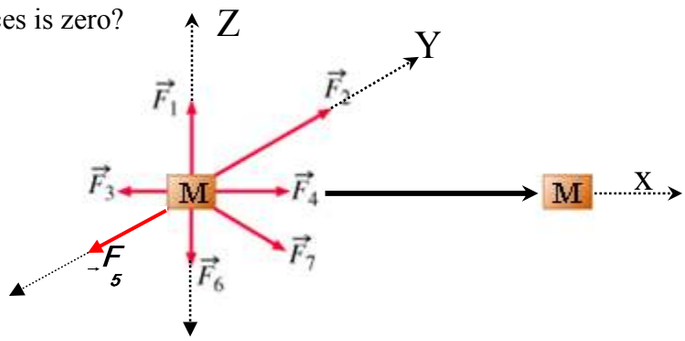

a. F_7 only
b. F_3 only
(c.) F_1, F_2, F_5, and F_6
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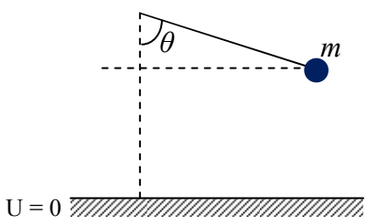


a. $\theta = 30$
b. $\theta = 45$
(c.) $\theta = 60$
d. $\theta = 0$

Part II: *Solve the following problems:*

1. A 1.5 Kg body has an acceleration of $(4\hat{i} - 3\hat{j})$ m/s^2. Only two forces act on the mass. If one of the forces is $(2\hat{i} - 1.4\hat{j})$ N, what is the magnitude of the other force?

$$\vec{a} = (4\hat{i} - 3\hat{j})\ m/s^2$$

$$\vec{F}_1 = (2\hat{i} - 1.4\hat{j})\ N$$

$$\vec{F}_1 + \vec{F}_2 = m\vec{a}$$

$$(2\hat{i} - 1.4\hat{j}) + (\vec{F}_2) = 1.5(4\hat{i}\ \ 3\hat{j})$$

$$(\vec{F}_2) = 6\hat{i} - 4.5\hat{j} - 2\hat{i} + 1.4\hat{j}$$

$$= 4\hat{i} - 3\hat{j}$$

$$F_2 = \sqrt{(4)^2 + (-3.1)^2} = 5.1\,N$$

2. Two blocks connected by a string are pushed across a horizontal surface by a force applied to one of them as shown in the figure below. The coefficient of kinetic friction μ_k between the blocks and the surface is 0.2. If F = 20 N, M = 1.5 Kg, find the tension in the string between the blocks.

$$F - T - \int_{1^K} = 2Ma$$

$$T - \int_{2^K} = Ma$$

$$F - \int_{1^K} - \int_{2^K} = 2Ma + Ma$$

$$20 - M_k g(3M) = 3Ma$$

$$20 - (0.2)(10)(4.5) = 4.5a$$

$$a = 2.44\ m/s^2$$

$$T = Ma + \int_{2k}$$

$$= (1.5)(2.44) + (0.2)(10)(1.5)$$

$$= 6.66\ N$$

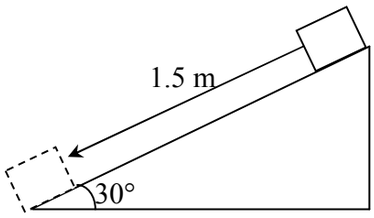
3. A strong steady wind provides a force of 150 N in a direction 30^o East of North on a pedestrian. If the pedestrian walks first 100 m North and then 200 m East, what is the total work done by the winds?

$$W = \vec{F}.\vec{\rho}$$

$$= (150\cos 60^o\,\hat{i} + 150\sin 60^o\,\hat{j}).(200\hat{i} + 100\hat{j})$$

$$= 15{,}000 + 12{,}990 \cong 28\,KJ$$

4. A 5 Kg package slides down a long ramp as shown in the figure below. The coefficient of kinetic friction between the package and the ramp is 0.31. If the package has a speed of 2.2 m/s at the top of the ramp, what is its speed after sliding 1.5 m? (Energy method)



$$W_f + mgh + \frac{1}{2}mv_1^2 = \frac{1}{2}mv_2^2$$

$$= -2\mu g\cos\theta x + 2g x\sin\theta + v_1^2 = v_2^2$$

$$= -2(0.31)(10)\cos 30\,(1.5) + 2(10)(1.5)\sin 30 + (2.2)^2$$

$$-8.05 + 15 + 4.84 = v_2^2$$

$$3.43 = v_2$$

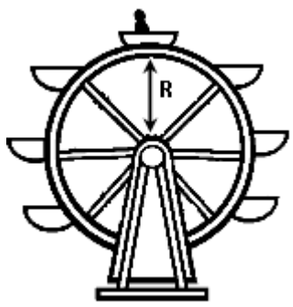
5. A 3.00-kg block is connected to two ideal horizontal springs having force constants $K_1 = 27.0$ N/cm and $K_2 = 20.0$ N/cm. The system is initially in equilibrium on a horizontal, frictionless surface. The block is now pushed 15.0 cm to the right and released from rest. What is the maximum speed of the block in cm/s?

$$\frac{1}{2}k_1 x^2 + \frac{1}{2}k_2 x^2 = \frac{1}{2}mv^2$$

$$\left[\frac{x^2}{m}(k_1 + k_2)\right]^{1/2} = V$$

$$\left[\frac{(0.15\,\text{m})^2\,(2700 + 2000)\,\text{N/m}}{3\,\text{ks}}\right]^{\frac{1}{2}} = 5.94\ \text{m/s} = 594\,\text{cm/s} = V$$

6. A 50 Kg child riding a Ferris wheel of radius 10 m travels in a vertical circle. The wheel completes one revolution every 10 s. What is the magnitude of the force on the child by the seat at the highest point on the circular path?



$$Mg - N = M\frac{u^2}{R}$$

$$v = \frac{d}{t} = \frac{2\pi R}{10} = \frac{2\pi 10}{10} = 2\pi\,\text{m/s}$$

$$N = Mg - \frac{Mu^2}{R}$$

$$= M\left(g - \frac{u^2}{R}\right)$$

$$= 50\left(10 - \frac{4\pi^2}{10}\right) = 302.6\,\text{N}\ \text{ upward.}$$