Kuwait University

Physics Department
Physics 101

I

Final Exam
Summer 2008
Sunday, August 3rd 2008
2:00 p.m. – 4:00 p.m.

Student's Name: ……...…………………………………………………………………………………

MODEL ANSWER

Student's Number: ……………………………………………………………………………………

Choose your Instructor's Name:

Drs. Al-DOSSARI Fatma, AL-JASSAR Ahmed, AL-JASSAR Halah.,

AL-REFAE Tarek, AL-YASEEN Adnan, EL-AKKAD Fikry, ZAHER Ashraf.

Grades:

#	Q1	Q2	Q3	Q4	Q5	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Total
Points																

Important:
1. Answer all questions and problems.
2. Each question will be assigned 1 point.
3. Each problem will be assigned 2 points.
4. No solution = no points.
5. Check the correct answer for each question.
6. Assume 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: Questions (Choose the correct answer)

1. Ball A is released from the top of a building. Two seconds later, ball B is released from the same building. As the time goes on, the distance between them:

a) decreases

b) remains constant

c) increases

d) can not be determined from the information given

2. You push against a stationary brick wall with a force F If the force is doubled, the amount of work you do.

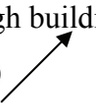
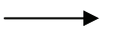
a) doubles

b) is cut in half

c) remains constant at zero

d) remains constant but non-zero

3. A stone is thrown from a high building with speed v in one of the following directions;

a)  b)  c)  d) 

In which case will the speed of the stone be greatest when it hits the ground below?

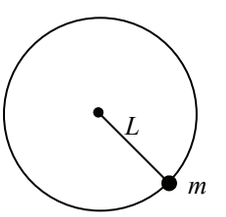
1) Case a 2) Case b 3) Case c 4) Case d

5) The speed will be the same in all cases

4. A ball of mass m, at one end of a string of length L, rotates in a vertical circle just fast enough to prevent the ball from falling at the top of the circle. The speed of the ball at the bottom of the circle is:

a) $\sqrt{4gL}$ b) $\sqrt{3gL}$ c) $\sqrt{2gL}$

d) $\sqrt{5gL}$ e) $\sqrt{7gL}$



5. Momentum may be expressed in

a) kg/m b) grams .s c) N · s d) kg/m · s e) N/s

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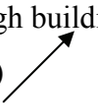
a)  b)  c)  d) 

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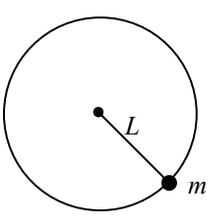


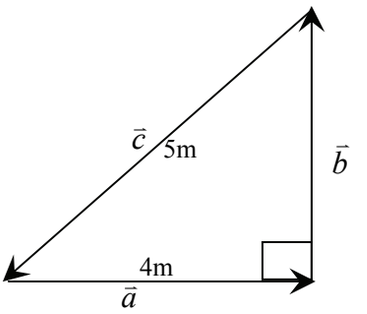
5. Momentum may be expressed in

a) kg/m b) kg/m s^2 c) N/s d) kg/m · s e) N · s

Part II: Problems (solve the following problems)

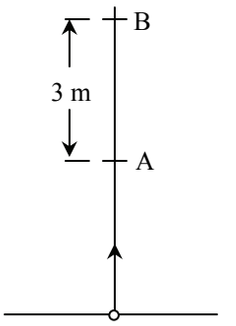
1. For the vectors shown: Find $\vec{b}\cdot\vec{c}$

$$b=\sqrt{5^2-4^2}=3$$
$$\vec{b}\cdot\vec{c}=bc\cos\phi$$
$$=-3\left(5\frac{3}{5}\right)$$
$$\vec{b}\cdot\vec{c}=-9\,m^2$$



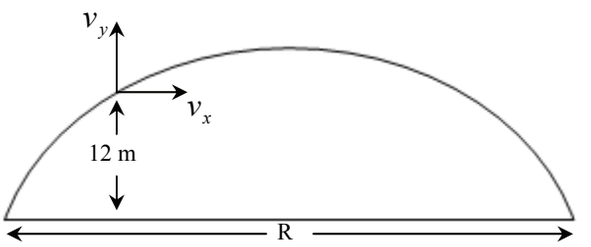
2. A stone is thrown vertically upward. On its way up it passes point *A* with speed *v*, and point *B*, 3 m higher than *A*, with speed $\frac{1}{2}v$, find the speed *v*(in m/s).

$$v^2=v_o^2-2g\,\Delta y$$
$$\left(\frac{1}{2}v\right)^2=v^2-2(10)(3)$$
$$\frac{3}{4}v^2=60$$
$$v=8.9\,m/s$$



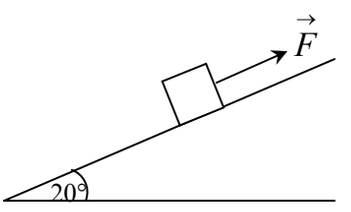
3. A ball is shot from the ground level and returns back to the ground after traveling a horizontal distance R (sometimes called "the range") . At a height of 12 m, the velocity is observed to be $\vec{v}=10\hat{i}+7\hat{j}$ m/s. Find the value of R (in m).

$$v_{ox}=v_x=10\,m/s$$
$$v_y^2=v_{oy}^2-2g\,\Delta y$$
$$7^2=v_{oy}^2-2(10)(12)$$
$$v_{oy}=17\,m/s$$
$$R=\frac{2v_{ox}\,v_{oy}}{g}=\frac{2(10)(17)}{10}=34\,m$$



4. A block weighing 80 N rests on a plane inclined at 20° to the horizontal (see figure). The coefficient of static friction is $\mu_S = 0.25$ and the coefficient of kinetic friction $\mu_K = 0.15$. What is the minimum magnitude of the force $\vec{F}$ (in N), parallel to the plane that will prevent the block from sliding down the plane?

$$\Sigma F_x=mg\sin\theta-F-\mu_s\,mg\cos\theta=0$$
$$F=80\sin 20-0.25(80)\cos 20$$
$$F=8.56\,N$$



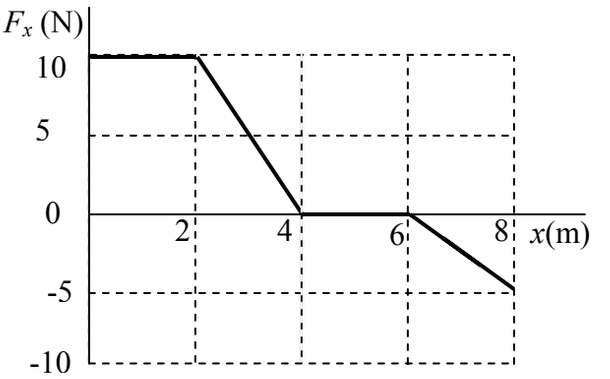
5. The only force acting on a 2 kg as it moves along the *x*-axis varies as shown. If the speed of the mass at *x* = 0 is 4 m/s, find its speed (in m/s) at *x* = 8m.

$W_{tot} = \Delta k$

area under the curve = $K_f - K_i$

$$2(10)+\frac{1}{2}(2)(10)+\frac{1}{2}(2)(-5)=\frac{1}{2}(2)v^2-\frac{1}{2}(2)(4)^2$$

$$v = 6.4\,m/s$$



6. A 2 kg block is placed on a 40° incline and is connected to a horizontal spring. (k = 160 N/m) by a string that passes over a frictionless pulley (see figure). The block is released from rest when the spring is unstretched. It then moves a distance 0.12 m down the plane before coming momentarily to rest while the spring is at maximum extension. What is the coefficient of kinetic friction μ_k between the block and the incline?

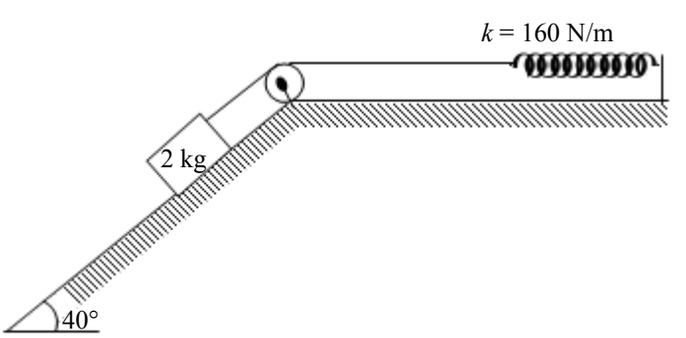
$$W_f = \Delta E \Rightarrow W_f = (u_f + K_f) - (u_i + K_i)$$

$$-\mu_k (mg\cos\theta)x = \frac{1}{2}kx^2 - mg\,x\sin\theta$$

$$-\mu_k (2(10)\cos 40)(0.12)$$

$$= \frac{1}{2}(160)(0.12)^2 - 2(10)(0.12)\sin 40$$

$$\mu_k = 0.21$$



7. A wheel, starting from rest, turns through 8.0 revolutions in a time interval of 17s. Assuming constant angular acceleration, what is the angular speed (in rad/s) at the end of this time interval?

$$\Delta\theta = \left(\frac{w+w_o}{2}\right)t$$

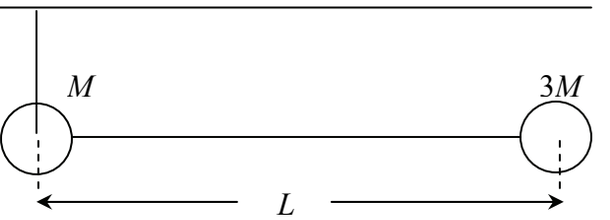
$$8(2\pi) = \left(\frac{w+o}{2}\right)17$$

$$w = 5.9\,rad/s$$

8. At the instant a 2 kg particle has a velocity of 4 m/s in the positive *x*-direction, a 3 kg particle has a velocity of 5 m/s in positive y direction. What is the speed (in m/s) of the center of mass of the two particle system?

$$(m_1+m_2)\vec{v}_{CM}=m_1\vec{v}_1+m_2\vec{v}_2$$
$$(2+3)\vec{v}_{CM}=2(4)\hat{i}+3(5)\hat{j}$$
$$\vec{v}_{CM}=1.6\hat{i}+3\hat{j}$$
$$v_{CM}=\sqrt{1.6^2+3^2}=3.4\,m/s$$

9. The system shown rotates about an axis through its center of mass and perpendicular to the paper. If M = 2 kg and L = 0.80 m, what is the kinetic energy (in J) of the system when its angular speed about this axis is 5 rad/s . (Neglect the mass of the connecting rod and treat the masses as particles)



$$(M+3M)\,x_{CM}=0+3ML$$
$$x_{CM}=\frac{3}{4}L=\frac{3}{4}(0.8)$$
$$x_{CM}=0.6\,m$$
$$I=m_1r_1^2+m_2r_2^2\Rightarrow I=M(0.6)^2+3M(0.2)^2$$
$$I=0.96\ kg\,m^2$$
$$K=\frac{1}{2}I\omega^2=\frac{1}{2}(0.96)(5)^2=12\,J$$

10- The speed of a 2.0 kg object changes from 30 m/s to 40 m/s during a 5.0 s time interval. During this time, the velocity of the object changes its direction by 90°. What is the magnitude of the average total force acting on the object during this time interval?

$$\vec{F}\Delta t=m\vec{v}-m\vec{v}_o$$
$$\vec{F}=-12\hat{i}+16\hat{j}$$
$$F=\sqrt{12^2+16^2}$$
$$F=20N$$