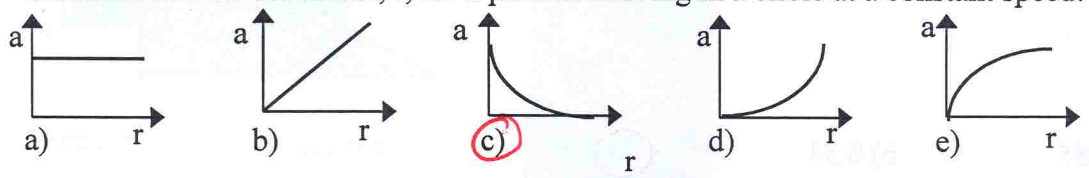
Key

The Hashemite University **Faculty of Science and Arts**
Department of Physics
Physics 101 Second Exam *Time 45 Minutes*

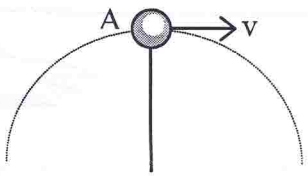
إسم الطالب (باللغة العربية): ..... الرقم الجامعي: .....
إسم مدرس المادة: ..... الشعبة: .....

Please note that:
1. Acceleration due to gravity, g = 10 m/s^2.
2. Encircle the answer that is nearest to your correct answer.

Q1) Which one of the following graphs represents correctly the variation of the radial acceleration with the radius, r, for a particle moving in a circle at a constant speed:



Q2) A stone of weight w is attached to one end of a 2 m long string whose other end is fixed. If the stone is rotated in a vertical circle and the speed at point A is 5 m/s, then the tension (in N) in the string is:



a) w b) 2w c) 3w/2 d) w/4 e) 5w/2

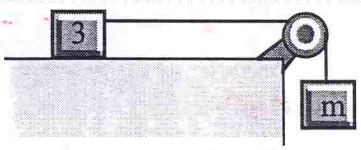
Q3) A stone is thrown from a building of height 20 m with an initial velocity **v** = 30 ***i*** m/s. What is the magnitude of its velocity (in m/s) just before it hits the ground below?

a) 25 b) 36 c) zero d) 32 e) 30

Q4) At time t = 0, a particle starts from the origin with a velocity of 9***j*** (m/s) and acceleration of 3***i*** - 4***j***. At the instant the x-component of the particle is 15 m, what is the speed (in m/s) of the particle?

a) 10 b) 16 c) 13.3 d) 14.5 e) 20

Q5) The system shown is released from rest. Ignoring friction, if the mass m moves 100 cm in 1 second, what is the value of m (in kg).



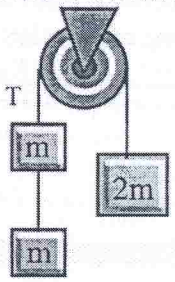
a) 0.42 b) 0.33 c) 0.5 d) 0.59 e) 0.75

Q6) If $\mu_k = 0.4$, find the acceleration (in m/s^2) of the block in the figure.

a) 2.8 b) 2.3 c) 1.8 d) 3.3 e) 0.44

2nd

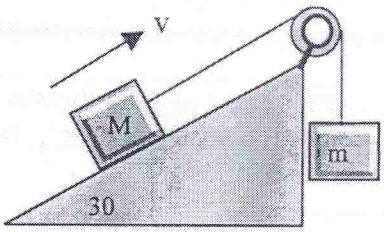
Q7) In the figure below, if m = 2 kg, then the tension T (in N) in the string connecting between the blocks is:



a) 20 b) 30 c) 40 d) 50 e) 80

2nd

Q8) The masses shown in the figure move at a constant speed. If M = 10 kg and m = 10 kg, then the coefficient of friction between block M and the surface is:



a) 0.85 b) 0.34 c) 0.57 d) 0.22 e) zero

Good luck

The Hashemite University
Depeatment of Physics

General Physics (101)
Second Exam

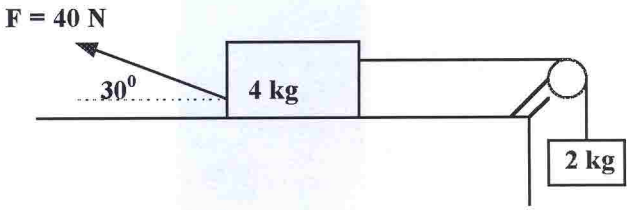
Time : 1 hour

Student Name : ----------

1) A 4 kg mass is acted upon by two forces ; $\vec{F}_1 = (12\,\hat{i} + 22\,\hat{j})$ N and $\vec{F}_2$. If the acceleration of the object is $\vec{a} = (5\,\hat{i} + 3\,\hat{j})$ m/s^2 , then the magnitude (N) of $\vec{F}_2$ is :

a) 12.8 b) 2.1 c) 18.7 d) 5.3 e) 9.2

2) In the figure shown what is the magnitude of the acceleration (m/s^2) of the 2.0 kg mass ?

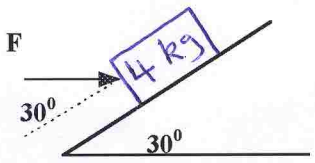


a) 1.2 b) 2.0 c) 1.5 d) 3.1 e) 2.4

3) A 6.0 kg object is suspended by a vertical string from the ceiling of an elevator which is accelerating upward at a rate of 1.8 m/s^2 . The value of the tension (N) in the string is :

a) 71 b) 48 c) 11 d) 59 e) 65

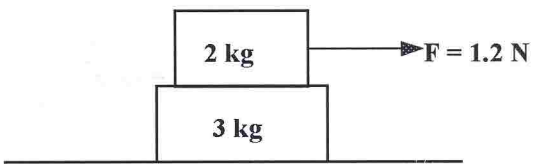
4) In the figure shown if the acceleration of the block is 2 m/s^2 up the plane , then the magnitude of $\vec{F}$ (N) is :



a) 14.1 b) 10.2 c) 21.7 d) 32.3 e) 9.6

5) Two blocks are accelerated accross a horizontal frictionless surface as shown. Frictional forces keep the two blocks from sliding relative to each other , and the two blocks move with the same acceleration . What is the force of friction (N) exerted by the 2 kg block on the 3 kg block ?

a) 0.48 to the right .
b) 0.72 to the left .
c) 0.72 to the right .
d) 0.48 to the left .
e) 0.16 to the right .



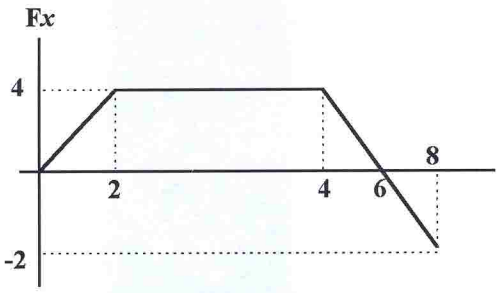
6) A 500 kg roller-coaster has a speed of 8 m/s at the top of a hill of radius 15 m as shown . What is the force (N) of the track on the car at the top of the hill ?

a) 3500 up .
b) 2867 down .
c) 7000 up .
d) 7000 down .
e) 2867 up .

7) If the coefficient of static friction μ_s between the tires of a car and the road is 0.25 . At what maximum speed (m/s) can a car round a level curve of 50 m radius without sliping ?

a) 22.3 b) 11.2 c) 9.6 d) 25.9 e) 14.5

8) An object moving a long the x-axis is acted upon by a force F_x that varies with position as shown . What work (J) is done by this force as the object moves from $x = 0$ m to $x = 8$ m .

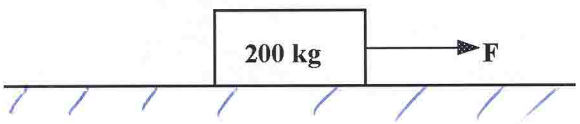


a) 30 b) 9 c) 21 d) 14 e) 18

9) A machine pushes a 2500 kg car from rest to a speed V doing 5000 J of work in the process . The value of V (m/s) is :

a) 1.1 b) 2.0 c) 0.5 d) 3.0 e) 4.2

10) A 200 kg object is pulled along a horizontal surface by a force F as shown . If the coefficient of kinetic friction $\mu_k = 0.4$, how much power (watt) must the force deliver to move the object at constant speed of 5 m/s ?

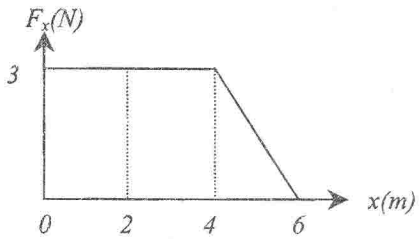


a) 1050 b) 2070 c) 4000 d) 3200 e) 4950

****GOOD LUCK****

Q.1: A force acting on an object varies with x as shown. The work done *(in J)* by the force as the object moves from $x = 0$ to $x = 6m$ *is:*

(a) Zero; *(b) 5;* *(c) 10;*
(d) 15; *(e) 25.*



Q.2: A boy pulls a $12kg$ crate (تقص) that rests on a horizontal surface by a force that is 30° above the horizontal. If $\mu_s = 0.4$, then the minimum force *(in N)* the boy needs to start the crate moving is:

(a) 71 *(b) 56* *(c) 54* *(d) 45* *(e) 47*

Q.3: A $90kg$ man stands in an elevator that is moving up at a constant speed of $5m/s$. The magnitude of the force *(in N)* exerted by the man on the floor is:

(a) zero *(b) 90* *(c) 900* *(d) 450* *(e) 50*

Q.4: A horizontal force of $12N$ pushes on a $0.5kg$ block against a vertical wall. The block is initially at rest. If $\mu_s = 0.6$ and $\mu_k = 0.4$, then the acceleration *(in m/s^2)* of the block is:

(a) 19.7 *(b) 14.4* *(c) 9.8* *(d) 9.4* *(e) zero*

Q.5: A particle moves $5m$ in the positive x-direction while being acted upon by a constant force given by: $\mathbf{F}=(4\mathbf{i}+2\mathbf{j}-4\mathbf{k})$ *N*. The work done *(in J)* by the force is:

(a) 20 *(b) 10* *(c) -20* *(d) 30* *(e) 5*

Q.6: At $t = 0$, a 2kg particle has a velocity $(4\mathbf{i}-3\mathbf{j})$ m/s. At $t = 3s$, its velocity is $(2\mathbf{i}+3\mathbf{j})$ *m/s*. During this time interval, the net work done *(in J)* on the particle is:

(a) 4 *(b) -4* *(c) -12* *(d) -40* *(e) $4\mathbf{i}-36\mathbf{j}$.*

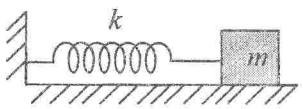
Q.7: An object moving on the x-axis is acted upon by a force given by: $F_x = (3x^2 - 16x)$ *N* where x is in meter. The work *(in J)* done by this force as the object moves from $x = -2m$ to $x = 1m$, is:

(a) +33 *(b) +16* *(c) -5* *(d) -24* *(e) +5*

Q.8: A 6.0-kg block slides along a horizontal surface. If $\mu_k = 0.20$ for the block and surface, then the rate *(in W)* the friction force is doing work on the block at an instant when its speed is $4.0m/s$, is:

(a) –60 *(b) –48* *(c) –70* *(d) –82* *(e) +70*

Q.9: The block shown is attached to the spring. The horizontal surface on which the block slides is frictionless. If $k = 1000N/m$, $m = 2.0$kg, and the speed of the block as it slides through the equilibrium position is equal to $5.0m/s$, then the kinetic energy *(in J)* of the block after it slides $20cm$ beyond the equilibrium position is:



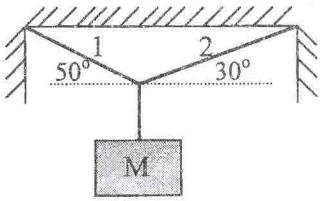
(a) 44 *(b) 16* *(c) 29* *(d) 5* *(e) 20*

Q.10: A highway curve has a radius of $0.14km$ and is unbanked. A car weighing $12kN$ goes around the curve at a speed of $24m/s$ without slipping. The magnitude of the horizontal force *(in kN)* of the road on the car?

(a) 12 *(b) 17* *(c) 13* *(d) 5* *(e) 10*

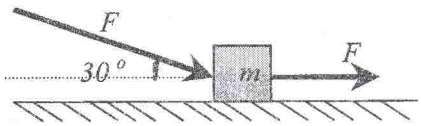
Q.11: If M = 4.5*kg*, The tension *(in N)* in string 1, is:

(a) 56 *(b) 48* *(c) 40*
(d) 65 *(e) 22*



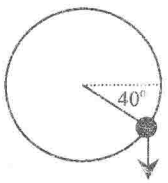
Q.12: The horizontal surface on which the block slides is frictionless. If $F = 20N$ and $m = 5.0\ kg$, then the magnitude of the resulting acceleration *(in m/s^2)* of the block is:

(a) 5.3 *(b) 6.2* *(c) 7.5* *(d) 4.7* *(e) 3.2*



Q.13: A 0.40*kg* mass attached to the end of a string swings in a vertical circle having a radius of 1.8*m*. At an instant when the string makes an angle of 40° below the horizontal, the speed of the mass is 5.0*m/s*. The tension *(in N)* in the string at this instant is:

(a) 9.5 *(b) 3.0* *(c) 8.1* *(d) 5.6* *(e) 4.7*



DEPARTMENT OF PHYSICS

PHYSICS 101.03 , QUIZ IV — DR. HALLAK

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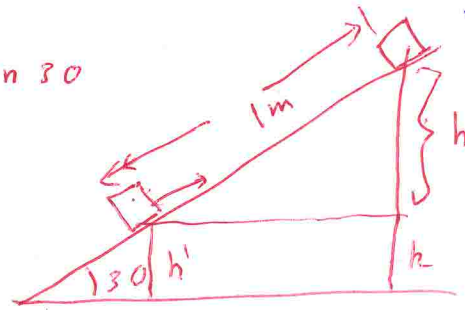
Q1: A block of mass 1.00 Kg is released from rest at the top of an inclined plane making an angle of 30.0 degrees with the horizontal. The coefficient of kinetic friction is 0.30 . What is the speed of the block after it has travelled 1.00 m downwards along the inclined plane.

A. 3.58 m/s
B. 2.17 m/s
C. 3.33 m/s
D. 2.50 m/s
E. 3.07 m/s

$\frac{h-h'}{1} = \sin 30$



$E_{up} = mgh = 1 \times 9.8 \times h = 9.8h$

$E_{down} = mgh' + \frac{1}{2}mv^2 = 1 \times 9.8 h' + \frac{1}{2} \times 1 \times v^2$

$\Delta E = W_f \Rightarrow 9.8h' + 0.5v^2 - 9.8h = -\mu_k mg\cos 30 \times 1$

$0.5v^2 - 9.8(h-h') = -0.3 \times 1 \times 9.8 \cos 30 \times 1$

$0.5v^2 = 9.8 \sin 30 - 0.3 \times 9.8 \cos 30$

$\Rightarrow v^2 = 2 \times 9.8 (\sin 30 - 0.3 \cos 30)$

$\Rightarrow v = 2.17$ m/s

Q2: A 0.20 Kg block on a horizontal, frictionless surface is connected to one end of a spring of force constant of 40 N/m. The other end of the spring is held fixed. The block is released when the spring is stretched 0.60 m from its equilibrium position. Find the speed of the block when the spring is compressed 0.20 m from its equilibrium position.

A. 6.49 m/s
B. 8.94 m/s
C. 6.00 m/s
D. 8.00 m/s
E. 7.50 m/s

By conservation of mechanical energy

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2 + \frac{1}{2}kx'^2$

$\frac{1}{2} \times 40 \times (0.6)^2 = \frac{1}{2} \times 0.2 v^2 + \frac{1}{2} \times 40 \times (0.2)^2$

$\Rightarrow v = 8$ m/s

8

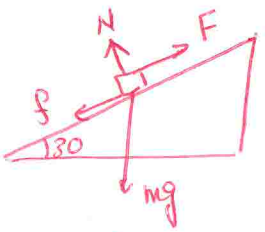
DEPARTMENT OF PHYSICS

PHYSICS 101.10
QUIZ III

NAME:---------- I D # :----------

Q1: A 2-Kg block moves up a 30 deg rough incline with a constant speed of 4 m/s under the action of a force F applied parallel to the incline. If the coefficient of kinetic friction is 0.2 , calculate the power delivered by F.

A. 66.36 Watt
B. 52.78 Watt
C. 39.20 Watt
D. 27.16 Watt
E. 78.54 Watt



$F = \mu_k N + mg\sin 30$

$= \mu_k mg\cos 30 + mg\sin 30$

$= mg(\mu_k \cos 30 + \sin 30)$

$= 2 \times 9.8(0.2\cos 30 + \sin 30)$

$= 13.19$ N

$P = F v = 13.19 \times 4$

$= 52.78$ Watt.

Q2: A 1-Kg block is attached to a spring of force constant 100 N/m . The spring is lying on a horizontal rough surface with one end fixed. The spring is compressed 0.196 m from its equilibrium position and then released. If the block first comes to rest when the spring is stretched 0.049 m, find the coefficient of friction between the block and the surface.

A. 0.75
B. 0.186
C. 1.0
D. 0.5
E. 0

Assume mechanical energy E_1 at position 1

" " " E_2 at " 2.

Total distance travelled by the mass

$\Delta x = 0.196 + 0.049 = 0.245$ m

$W_f = -\mu_k mg\,\Delta x = -\mu_k(1 \times 9.8 \times 0.245)$

$= -2.40\,\mu_k$

$W_f = \Delta E = E_2 - E_1 = \frac{1}{2}kx_2^2 - \frac{1}{2}kx_1^2$

$= \frac{1}{2} \times 100[(0.049)^2 - (0.196)^2]$

$= -1.80 \Rightarrow \mu_k = 0.75$

PHYSICS 101

QUIZ # III

(DR. Hallak) 9

STUDENT NAME. Key I.D. # _____

Q1: Calculate the kinetic energy that the Earth has owing to its motion around the sun. The mean radius of the orbit (assumed circular) is 1.50*10**(+11) m , and the mass of the Earth is approximately 5.98*10**(24) Kg.

$$v = \frac{2\pi r}{t} = \frac{2\pi \times 1.50\times10^{11}}{365\times24\times60\times60} = 2.99\times10^{4}\ m/s$$

$$K = \frac{1}{2}mv^2 = \frac{1}{2}\times5.98\times10^{24}\times(2.99\times10^{4})^2$$

$$= 2.67\times10^{33}\ J.$$

Q2: A parachutist of mass 60 Kg jumps out of a heliocapter standing at an altitude of 800 m. His parachute opens and he lands on the ground with a speed of 5.0 m/s. How much energy has been lost to air friction in this jump?

$$E_{up} = mgh = 60\times9.8\times800 = 470400\ J$$

$$E_{down} = \frac{1}{2}mv^2 = \frac{1}{2}\times60\times(5)^2 = 750\ J$$

$E_{up} - E_{down}$ = energy lost to air friction

$= 469650\ J$

Q3: A stone is tied to a string of length R. A man whirls this stone in a vertical circle. Assume that the energy of the stone remains constant as it moves around the circle. Show that if the string is to remain taut at the top of the circle, the speed of the stone at the bottom of the circle must be at least (5*g*R)**(1/2) .

Up position $mg = m\frac{v^2}{R} \Rightarrow v^2 = Rg$

$$E_{up} = mg(2R) + \frac{1}{2}mv^2 = 2mgR + \frac{1}{2}mgR$$

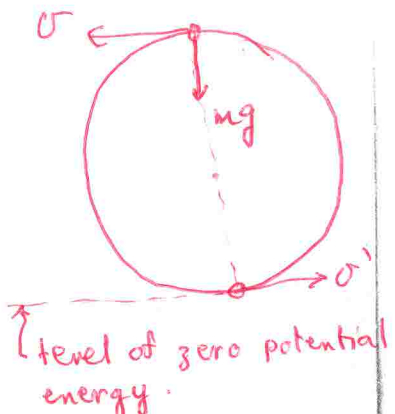
$$= \frac{5}{2}mgR$$

Down position

$$E_{down} = 0 + \frac{1}{2}mv'^2$$

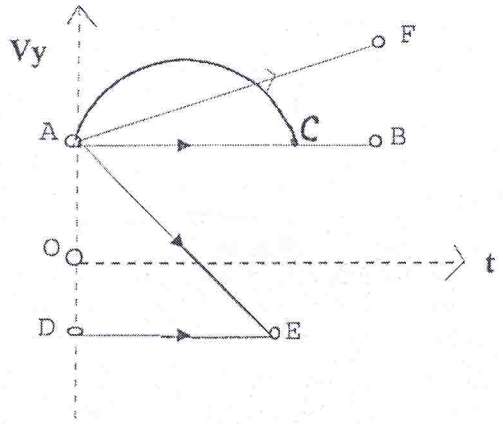
But $E_{up} = E_{down} \Rightarrow \frac{1}{2}mv'^2 = \frac{5}{2}mgR$

$\Rightarrow v' = \sqrt{5gR}$



1st

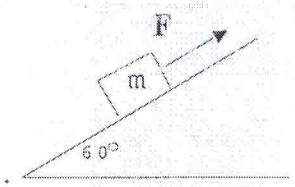
8. Which of the curves on the graph below best represents v_y vs. t for a projectile fired at an angle of 45° above the horizontal ?



A) OC B) AB C) DE D) AF E) AE

2nd

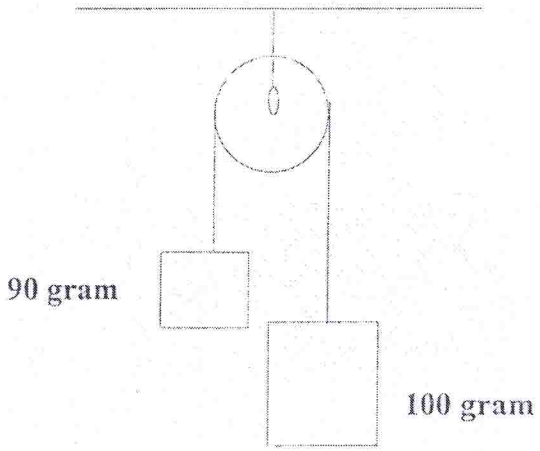
9. A force (F=40N) is applied on a box of mass M as shown. The acceleration of the box was $2m/s^2$ up the smooth incline.The mass (in kg) of the box is:



A) 3.75 B) 4.11 C) 5.71 D) 6.22 E) 10

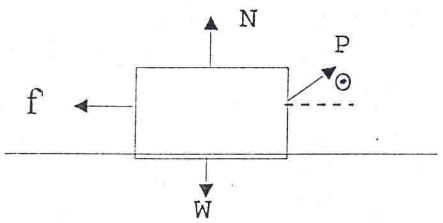
2nd

10. Two blocks are connected by a string and pulley as shown. Assuming that the string an pully are massless, the magnitude of the acceleration of each block is :



A) $0.049\ m/s^2$
B) $0.020\ m/s^2$
C) $0.0098\ m/s^2$
D) $0.53\ m/s^2$
E) $1.00\ m/s^2$

2nd 1. A boy pulls a wooden box along a rough horizontal floor at constant speed by means of a force P as shown. Which of the following must be true :

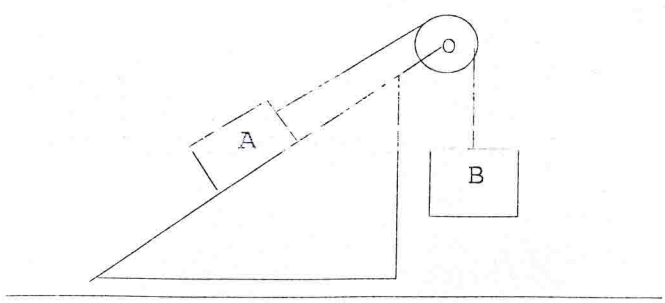


A) P = f and N = W
B) P = f and N > W
C) P > f and N < W
D) P > f and N > W
E) none of these

2nd 2. A block is placed on a rough wooden plane. It is found that when the plane is tilted 30° to the horizontal, the block will slide down at constant speed. The coefficient of kinetic friction of the block with the plane is :

A) 0.500 B) 0.577 C) 1.73 D) 0.700 E) 4.90

2nd 3. Block A, with a mass of 10 kg, rests on a 30° incline. The coefficient of kinetic friction is 0.20. The attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. Block B, with a mass of 8.0 kg, is attached to the dangling end of the string. The acceleration of B is :



A) 0.69 m/s^2, up
B) 0.69 m/s^2, down
C) 2.6 m/s^2, up
D) 2.6 m/s^2, down
E) 0

4. An object moves in a circle. If the mass is tripled, the speed halved and the radius unchanged then the centripetal force must change by a factor of :

A) 1/2 B) 3/4 C) 9/4 D) 6 E) 12

5. The work done by gravity during the descent (هبوط)of a projectile is :

A) Positive.
B) Negative.
C) Zero
D) Sign depends on the direction of the y-axis .
E) Sign depends on the direction of both the x-and y-axes.

6. An ideal spring is hung vertically from the ceiling. When a 2.0-kg mass hangs at rest from it the spring is extended 6.0 cm. A downward external force is now applied to the mass to extend the spring an additional 10 cm. While the spring is being extended by the force, the extra work done by the spring is :

A) -3.6 J
B) -3.3 J
C) $-3.4X10^{-5}$ J
D) 3.3 J
E) 3.6 J

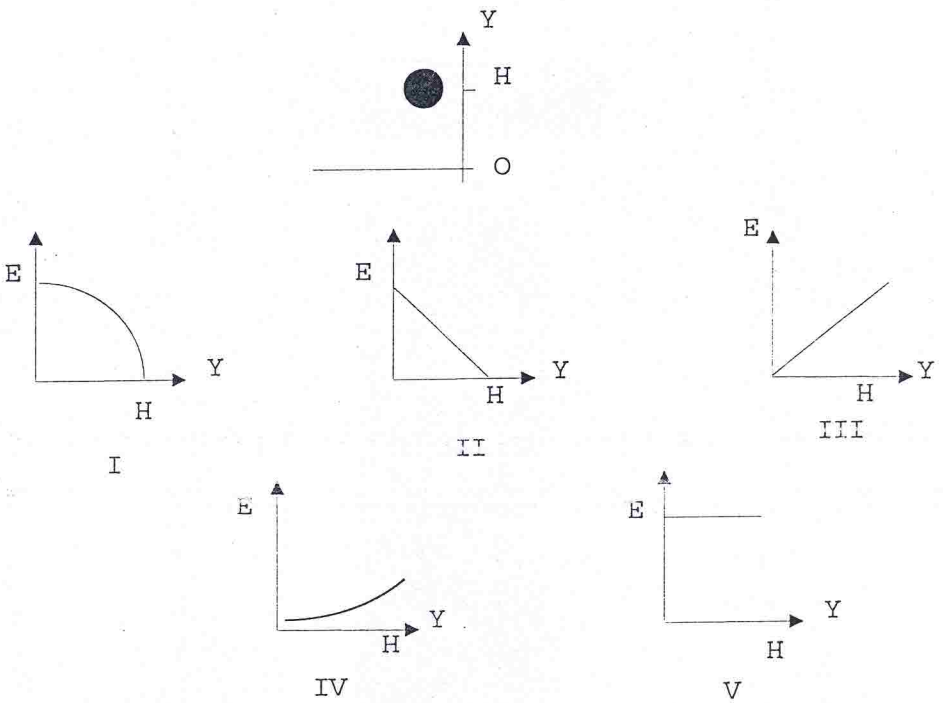
7. At time t= 0 a 2-kg particle has a velocity in m/s of $4\hat{i} - 3\hat{j}$. At t= 3 s its velocity in m/s is $2\hat{i} + 3\hat{j}$. During this time the work done on it was :

A) 4 J
B) -4 J
C) -12 J
D) -40 J
E) $4\hat{i} + 36\hat{j}$ J

8. A watt is :

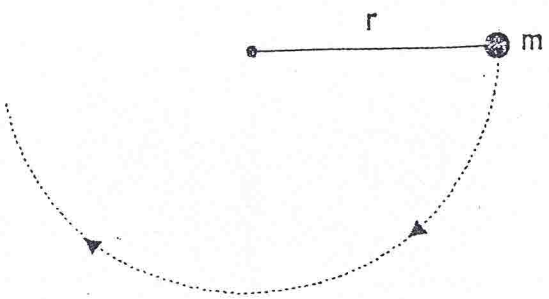
A) kg .m/s^3 B) kg .m^2/s C) kg .m^2/s^3 D) kg .m/s E) kg .m^2/s^2

9. A ball is held at a height H above a floor. It is then released and falls to the floor. If air resistance can be ignored which of the five graphs below correctly gives the mechanical energy E of the earth-ball system as a function of the altitude (ارتفاع) Y of the ball ?



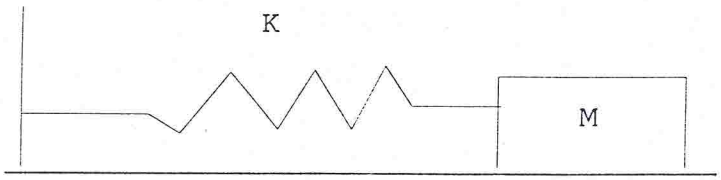
A) I. B) II. C) III. D) IV. E) V.

10. A small object of mass m, on the end of alight cord, is held horizontally at a distance r from a fixed support as shown. The object is then released. What is the tension in the cord when the object is at the lowest point of its swing ?



A) mg/2 B) mg C) 2mg D) 3mg E) mgr

11.

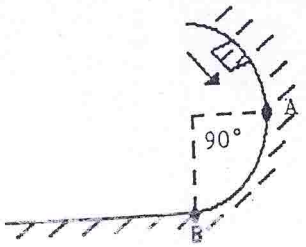


The block shown is released from rest when the spring is stretched a distance d. If k = 50 N/m, m = 0.50 kg, d = 10 cm, and the coefficient of kinetic friction between the block and the horizontal surface is equal to 0.25,then the speed of the block when it first passes through the position for which the spring is unstretched is :

A) 92 cm/s B) 61 cm/s C) 71 cm/s

D) 82 cm/s E) 102 cm/s

12.



A 1.2-kg mass is projected down a rough circular track (radius=2.0-m) as shwon. The speed of the mass at point A is 3.2 m/s, and at point B, it is 6.0 m/s . How much work is done on the mass between A and B by the force of friction ?

A) -8.9 J

B) -7.3 J

C) -8.1 J

D) -5.6 J

E) -6.7 J

Key

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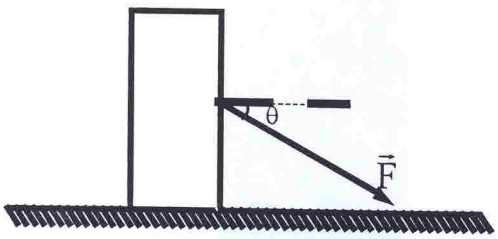
Department of Physics
Instructor: Dr. Awni Hallak

General Physics I
Section 5

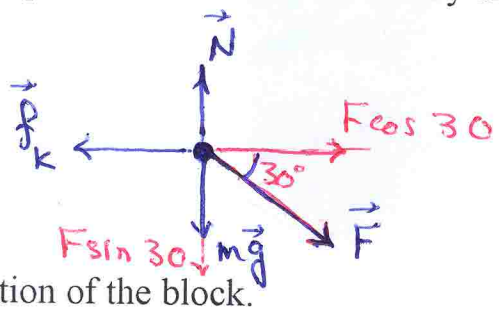
Quiz #3

Name:---------- I D Number:----------

A boy pulls on a 25 kg block with a force $\vec{F}$ of magnitude 35 N that makes an angle of 30° below the horizontal as shown in figure. The coefficient of kinetic friction between the block and the surface is 0.1 .



a) Draw in the space provided below the free body diagram for the block.



b) Find the acceleration of the block.

$\sum F_x = m a$

$F\cos 30 - f_k = m a$

$35 \cos 30 - 26.75 = 25 a$

$3.56 = 25 a$

$\Rightarrow a = 0.14 \ m/s^2$

$\sum F_y = 0$

$N - mg - F \sin 30 = 0$

$\Rightarrow N = mg + F \sin 30$

$= (25)(10) + 35 \sin 30$

$= 267.5$ Newton

$f_k = \mu_k N$

$= 0.1 \times 267.5$

$= 26.75$ Newton.

PHYSICS DEPARTMENT

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PHYSICS
QUIZ # IV

(DR. HALLAK)

STUDENT NAME. _____ I.D. # _____

Key

x 2nd Q1 : A 1 Kg block collides with a horizontal weightless spring of force constant 2.00 N/m . The block compresses the spring 5.00 m from the equilibrium position. The coefficient of kinetic friction between the block and the horizontal surface is 0.25 . What was the speed of the block at the instant of collision ?

A. 6.45 m/s
B. 4.22 m/s
C. 8.63 m/s
D. 7.18 m/s
E. 5.72 m/s

$\Delta E = W_f$

$E_f - E_i = W_f = -\mu_k m g d$

$\frac{1}{2}kx^2 - \frac{1}{2}mv^2 = -\mu_k m g x \quad d = x$

$\frac{1}{2}\times 2\times 5^2 - \frac{1}{2}\times 1\times v^2 = -0.25\times 1\times 9.8\times 5$

$\Rightarrow v = 8.63 \text{ m/s}$

x 2nd Q2: A bullet of mass 30.0 gm travelling at 600 m/s penetrates 12.0 cm into a block of wood fixed to the ground. What average force does it exert on the block?

A. 45000 N
B. 33800 N
C. 24200 N
D. 39200 N
E. 20000 N

$\Delta K = W_f$

$0 - \frac{1}{2}mv^2 = -Fd$

$\Rightarrow F = \frac{mv^2}{2d}$

$= \frac{0.030\,(600)^2}{2\times 0.12}$

$= 45000 \text{ N}$