Sonoma State University
Fall 2006

Physics 114
J. S. Tenn

Name_____

# Fifteen-Minute Quiz #1

no calculators

1. A particle is said to move with velocity $v(t) = Bt^2 - C$ where $B$ and $C$ are constants and $t$ is the time. What must be the dimensions of the constants $B$ and $C$? (6)

2. What is the acceleration of the particle described in question 1? (4)

3. A motor scooter accelerates at 3.6 mi/h per second. 1 mi = $1.61 \times 10^3$ m. Convert the acceleration to SI units. (5) YOU DO NOT NEED A CALCULATOR.

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# Fifteen-Minute Quiz #2

no calculators

1. The position of a particle as a function of time is given by $x(t) = At^3 - Bt$ where $A = 2$ m/s$^3$ and $B = 4$ m/s . What is the velocity of the particle at $t = 0$? Give your answer in m/s . (5)

2. What is the acceleration of the particle described in question 1 at $t = 1$ s? (5)

3. The velocity of a particle as a function of time is given by $v(t) = \left(3 \text{ m/s}^3\right) t^2$ . If it is at the origin at $t = 0$, where is it at $t = 2$ s? (5)

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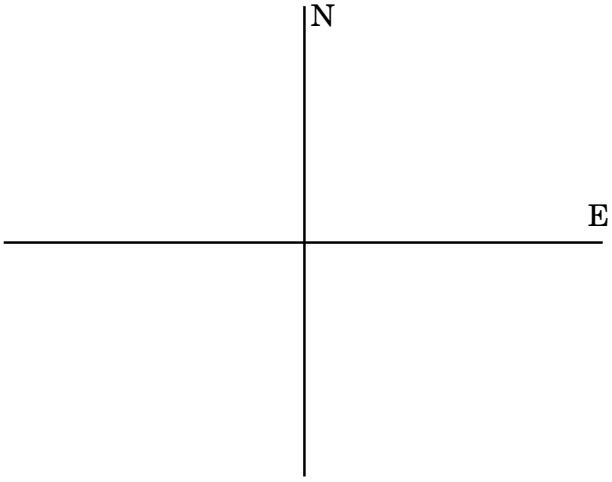
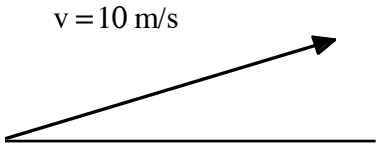
# Fifteen-Minute Quiz #3

no calculators

1. You row at 4 m/s in a direction 30° north of east relative to the water, which is flowing at 3 m/s northward. Draw the two velocities and find the north and east components of your resultant velocity relative to the shore. Feel free to call east *x* and north *y* if you wish. (6).




2. The velocity of a football is 10 m/s at an angle 30° above the horizontal. What is the horizontal component of this velocity? (4)

3. The position of a particle as a function of time is given by $\vec{r}(t) = \left(2\frac{\text{m}}{\text{s}^2}\right)t^2\,\hat{i} - \left(3\frac{\text{m}}{\text{s}}\right)t\,\hat{j}$. What is its **speed** at $t$ = 1 s? (5)

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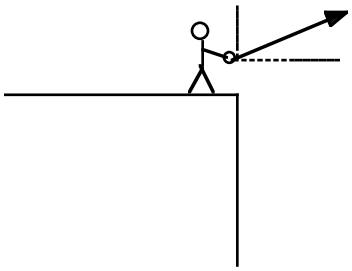
# Fifteen-Minute Quiz #4

no calculators, answers may contain square roots, products, etc.

You are exploring a planet where the gravitational field is exactly 10 N/kg. You stand on the edge of a cliff and throw a ball from a height one meter above the cliff top at an angle 30° above the horizontal at a speed of 8 m/s. (5)



(1) How long does it take before the ball reaches its highest point?

(2) How high is the ball, relative to the cliff top, 2 s after you throw it? (5)

(3) How far has the ball traveled in the horizontal directions after 2 s?

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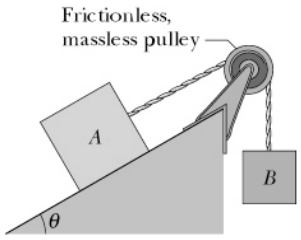
# Fifteen-Minute Quiz #5

no calculators, answers may contain square roots, products, etc.




The mass of A is $m_A$, the mass of B is $m_B$.
The ramp is at an angle $\theta$ above the horizontal. The pulley has negligible mass and friction. Initially B is falling.

1. Draw arrows representing all of the forces acting on A and on B, assuming there is friction between A and the ramp. Label each force. (3)

2. The problem contains a number of parameters: the two masses, the angle, the tension in the string, the coefficient of kinetic friction, and the strength of the gravitational field, along with the forces you introduced in question 1. Suppose you wish to find the acceleration. Write four equations relating these quantities, taking the acceleration as positive if it speeds up the fall of B. Do not solve these equations. (3 pts for each).

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# Fifteen-Minute Quiz #6

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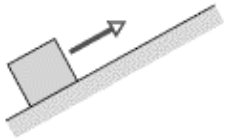

The block has mass $m$ = 20 kg, and it is initially sliding up the slope at speed $v_0$ = 30 m/s. It slides a distance $d$ = 10 m before coming to a stop. The slope has an elevation of 30°, and the local gravitational field is $g$ = 10 N/kg.

1. What is the initial kinetic energy of the block?

During this motion

2. How much work is done on the block by the normal force exerted by the slope?

3. How much work is done on the block by the Earth's gravity?

4. How much work is done on the block by friction?

5. What is the change in potential energy of the block?

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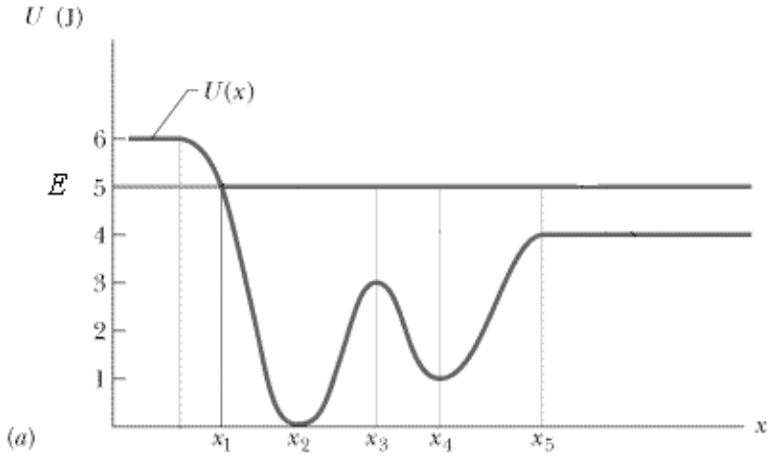
# Fifteen-Minute Quiz #7

no calculators, answers may contain square roots, products, etc.




A particle of mass $m$ = 5 kg is in the potential shown above. It starts at rest at $x_1$.

1. What is its total mechanical energy at $x_1$?

2. What is its total mechanical energy at $x_4$?

3. What is its kinetic energy at $x_3$?

4. Where is its speed greatest?

5. In a binary star system star A has a mass of 2 solar masses and star B has a mass of 1 solar mass. They are separated by 60 astronomical units. How far is the center of mass of the system from star A?

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# Fifteen-Minute Quiz #8

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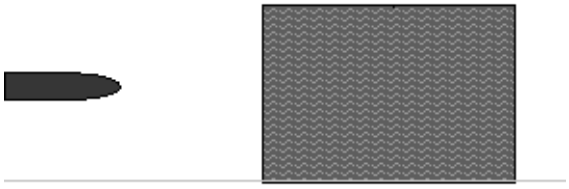

1. A bullet of mass 4 g is fired horizontally into a 6.0 kg wooden block at rest on a horizontal surface. The initial speed of the bullet is 600 m/s. What is the speed of the block containing the bullet just after the collision? You may assume that the mass of the block after absorbing the bullet is approximately the same as the initial mass of the block. (9)

2. Which of the following comes closest to describing the mechanical energy lost in the collision described in question 1? (3)

___a . No mechanical energy is lost; the collision is elastic.
___b. Half the mechanical energy is lost in the collision.
___c. Nearly all the initial mechanical energy of the bullet is lost in the collision.

3. Which of the best describes the momentum gained or lost in the collision described in question 1? (3)

___a . The total momentum after the collision is less than before the collision.
___b. The total momentum after the collision is the same as before the collision.
___c. The total momentum after the collision is greater than before the collision.

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# Fifteen-Minute Quiz #9

Circle the letter of the one best answer to each question.

1. When two uniform spheres are a distance r apart the gravitational force of each on the other has magnitude F. When their separation is reduced to r/2 the magnitude of the gravitational force is

a. F/4.
b. F/2.
c. F.
d. 2F.
e. 4F.

2. A minor planet is discovered orbiting the Sun at a distance of 4 AU, where the AU is the average distance of the Earth from the Sun. We should expect the period of the planet's orbit to be
a. 4 years.
b. 8 years.
c. 64 years.
d. 2 years.
e. impossible to determine.

3. A small projectile is fired straight up from the surface of an airless planet which has mass M and radius R. If the projectile is to excape the planet its initial speed mus be greater than or equal to
a. $\sqrt{GM/R}$.
b. $\sqrt{2GM/R}$
c. $\sqrt{GM/R^2}$
d. $\sqrt{2GM/R^2}$
e. It depends on the mass of the projectile.

4. A mass on a spring moves in such a way that its position is $x(t) = (2\text{ m})\cos\left[(\pi\text{ rad/s})t\right]$. Its period is
a. 0.5 s
b. 1 s.
c. 2 s.
d. 1/π s.
e. impossible to determine.

5. The frequency of the motion described in question 4 is
a. 0.5 Hz.
b. 1 Hz.
c. 2 Hz.
d. π Hz.
e. impossible to determine.

6. The amplitude of the motion described in question 4 is
a. 0.5 m
b. 1 m.
c. 2 m.
d. 4 m.
e. none of the above.

7. The spring constant of the spring in question 4 is
a. 0.5 N/m
b. 1 N/m.
c. 2 N/m.
d. 4 N/m.
e. impossible to determine.

8. Which of the following properties of a simple pendulum is a maximum when the mass passes through its lowest point?
a. acceleration.
b. net force.
c. kinetic energy.
d. potential energy.
e. none of the above..

9. A simple pendulum has a period of 2 s. If the same mass is suspended from a string 4 times as long, its period will be
a. 0.5 s
b. 1 s.
c. 2 s.
d. 4 s.
e. 8 s.

10. A simple pendulum has a period of 2 s. If 4 times the mass is suspended from a string of the original length, its period will be
a. 0.5 s
b. 1 s.
c. 2 s.
d. 4 s.
e. 8 s.

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# Fifteen-Minute Quiz #10

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1. A gas expands at a constant pressure of 100 kPa from a volume of 1 cubic meter to a volume of 3 $m^3$. In the process it also transfers 200 kJ of heat to its surroundings. What is the change in its internal energy?

2. If five grams of a liquid having a specific heat of 2 cal/(g·K) [twice that of water] and a temperature of 20°C is mixed with 15 grams of ice-cold water, and no heat is exchanged with the outside, what is the final temperature of the mixture?

3. True or false?

___(a) Ice melts at 0 K.

___(b) The equation $pV = nRT$ is valid if the temperature is expressed in degrees Fahrenheit, so long as the correct value of the gas constant is used.

___(c) The kelvin is the same size as the Celsius degree.

___(d) On a day when the high temperature is 60°F and the low is 30°F it is reasonable to say that the high temperature was twice as high as the low.

___(e) A contracting gas may do either positive or negative work, depending on the circumstances.