PHYS 100 PLT P00

Midterm Review Practice Problems

Spring 2010 Exam

QUESTION 1

Q1 & Q2 are about the following situation.

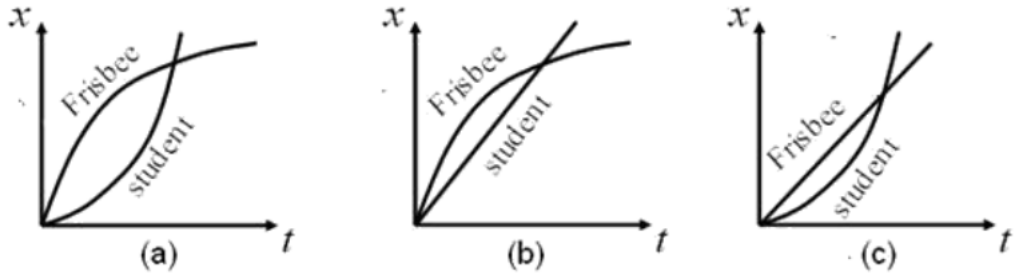
A PHYS 100 student, who is initially at rest, wants to catch a Frisbee. When the Frisbee passes over her head it is moving at a speed of 4 m/s, and this is when she starts to run in the same direction as the Frisbee, accelerating at a rate of 1 m/s^2. The Frisbee is decelerating at a rate of 1.5 m/s^2. (You may neglect the vertical motion of the Frisbee).

How long Δt will it take the student to catch the Frisbee?

(a) $\Delta t = 3.20$ s
(b) $\Delta t = 4.15$ s
(c) $\Delta t = 5.32$ s
(d) $\Delta t = 6.18$ s
(e) $\Delta t = 6.97$ s

QUESTION 2

Which one of the following graphs best represents the position (x) of the student and the Frisbee as a function of time, choosing $x = 0$ to be the initial location of the student and $t = 0$ to be the time when the students starts to run.



QUESTION 3

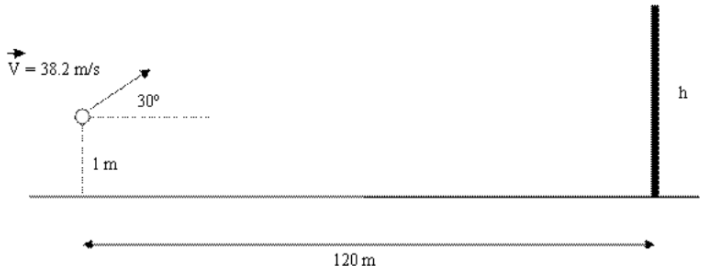
Which one of the following statements best describes the motion of an object that has a constant net force acting on it?

(a) Its acceleration must be in the same direction as the force.
(b) Its velocity must be in the same direction as the force.
(c) Its velocity is constant and is in the same direction as the force.

QUESTION 4

A baseball player wants to hit a home run over the far wall of a stadium. He hits the ball 1 meter above the ground so that its speed is 38.2 m/s and such that it makes an angle of 30° with respect to the horizontal. What is the tallest wall the player's ball can clear 120 m away?

(a) 2.98 m
(b) 3.22 m
(c) 5.06 m
(d) 5.74 m
(e) 6.28 m

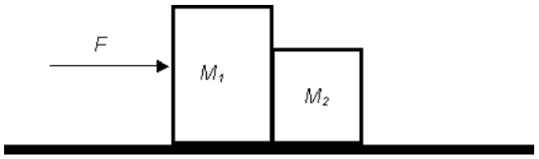


QUESTION 5

Q5, 6, 7 are about the following situation.

Two blocks, of mass $M_1 = 8$ kg and $M_2 = 3$ kg are in contact with each other on a frictionless floor. A horizontal force $F = 72$ newtons is applied to block M_1 as shown. What is the force F_{1on2} of the block of mass M_1 on the block of mass M_2?

(a) $F_{1on2} = 0.0$ N
(b) $F_{1on2} = 5.1$ N
(c) $F_{1on2} = 19.6$ N
(d) $F_{1on2} = 51.3$ N
(e) $F_{1on2} = 72.0$ N



QUESTION 6*

If the force F were doubled and the mass M_1 were doubled but M_2 is held the same, the force F_{1on2} would

(a) decrease.
(b) stay the same.
(c) increase.

QUESTION 7*

Suppose now that $F = 72$ N and $M_1 = 8$ kg again, but a coefficient of kinetic friction $m_k = 0.1$ between the floor and each of the blocks is introduced. The magnitude of ***<u>the total force</u>*** acting on M_2 is now

(a) bigger than it was without friction.
(b) smaller than it was without friction.
(c) the same as it was without friction.

QUESTION 8

Q8, 9, 10 are about the following situation.

Two stones are thrown simultaneously from a height of 500 m. The first stone is thrown vertically downward at a speed of 10 m/s, while the second stone is thrown vertically upward at a speed of 10 m/s. Immediately after the two stones are thrown, the difference in their **speeds** ($|v_{down}| - |v_{up}|$)

will …

(a) increase with time.
(b) decrease with time.
(c) stay the same.

QUESTION 9

During the time interval that both stones are in flight the difference in their **velocities** will

(a) increase.
(b) decrease.
(c) stay the same.

QUESTION 10

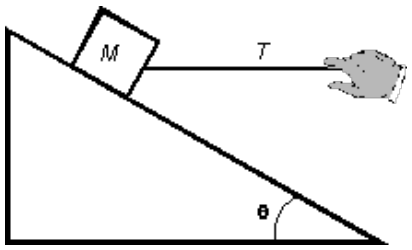
How long Δt will it take the second stone to get back down to the level from which it was thrown?

(a) $\Delta t = 2.04$ s
(b) $\Delta t = 3.02$ s
(c) $\Delta t = 4.62$ s
(d) $\Delta t = 5.38$ s
(e) $\Delta t = 6.02$ s

QUESTION 11

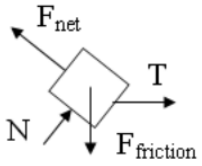
Q11, 12, 13 are about the following situation.

A block of mass $M = 2$ kg is on a stationary inclined plane inclined with an angle $\theta = 30°$. A horizontal rope is attached to the block and is pulled to the right with tension T. The tension remains horizontal even in the event that the block moves down the plane. The coefficient of static friction between the block and the inclined plane is $\mu_s = 0.7$ and the coefficient of kinetic friction is $\mu_k = 0.5$.



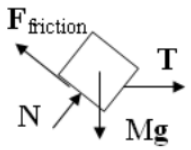
Which of the following is the correct free-body diagram for the block?

a.



b.

c.



QUESTION 12

What is T_{max} the maximum value of T for which the block can be held in place with static friction?

(a) $T_{max} = 0.18$ N
(b) $T_{max} = 0.37$ N
(c) $T_{max} = 0.63$ N
(d) $T_{max} = 1.71$ N
(e) The block remains held in place with static friction for all values of T.

QUESTION 13*

If θ were increased, the value of T_{max} found in the previous problem would…

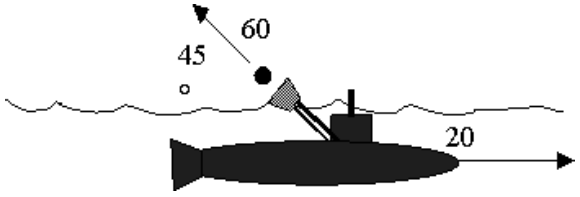
(a) decrease.
(b) stay the same.
(c) increase.

QUESTION 14

Q14, 15 are about the following situation.

A projectile is fired from a submarine traveling horizontally at 20 m/s with respect to the water as shown in the figure below. According to an observer on the submarine, the projectile is fired at 45° with an initial velocity of 60 m/s. After firing the projectile, the submarine continues to travel at 20 m/s. According to an observer watching from a boat that is stationary with respect to the water, what will be the angle θ that the projectile makes with respect to the horizontal when it is launched?

(a) $\theta = 30.9°$
(b) $\theta = 34.2°$
(c) $\theta = 45°$
(d) $\theta = 62.1°$
(e) $\theta = 71.6°$



QUESTION 15

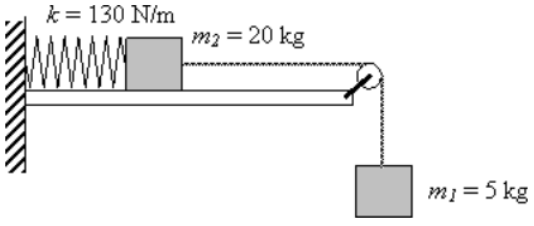
A tugboat captain also sees the submarine fire the projectile, but to him is looks like the projectile is moving straight up (i.e. 90° above the horizontal). What is the velocity of the tugboat relative to the water?

(a) 0 m/s
(b) 22.4 m/s in the opposite direction the submarine is moving
(c) 22.4 m/s in the same direction the submarine is moving
(d) 43.7 m/s in the opposite direction the submarine is moving
(e) 43.7 m/s in the same direction the submarine is moving

QUESTION 16*

Q16 & Q17 are about the following situation.

Block m_1 (5 kg) is hanging over the edge of a frictionless table and is attached to a block m_2 (20 kg) by a massless string that runs over a frictionless, massless pulley as shown in the figure. Block m_2 is also attached to a wall by an ideal, massless spring with a spring constant of 130 N/m that has a relaxed length of X_0.



By how much is the spring compressed or stretched relative to its relaxed length X_0 if the system is in equilibrium?

(a) The spring is compressed by 0.377 meters.
(b) The spring is compressed by 0.141 meters.
(c) The spring is neither compressed nor stretched.
(d) The spring is stretched by 0.141 meters.
(e) The spring is stretched by 0.377 meters.

QUESTION 17

Suppose the spring is compressed a distance 0.3 m from its relaxed length X_0 and then the system is released. What is the acceleration a of m_2 right after release.

(a) $a = 0.00$ m/s^2
(b) $a = 3.52$ m/s^2
(c) $a = 4.18$ m/s^2
(d) $a = 5.92$ m/s^2
(e) $a = 9.81$ m/s^2