Name:
Student Number:

Instructor:
Section Number:

PHY 1B03

Term Test #1

Thursday, October 10, 2002
7:30-8:30 pm

There are a total of 15 questions and they are each worth 1 point. There are no part marks. Only the McMaster standard calculator is allowed. A formula sheet can be found attached to this test paper.

All portable communications devices (pagers, cellular phones, etc) **must be off** during tests.

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1. You are measuring the magnitude of the tension in a string required to support a horizontal bar using a "Newton meter". The device can be read to 0.02 N. Five measurements of the same tension produce the following results:

   4.22 N 4.44 N 4.76 N 4.62 N 4.28 N

You would report the best estimate of the tension and its uncertainty as:

a) 4.46 ± 0.26 N
b) 4.46 ± 0.3 N
c) 4.5 ± 0.3 N
d) 4.5 ± 0.26 N
e) 4.464 ± 0.260 N
f) 4.46 ± 0.02 N

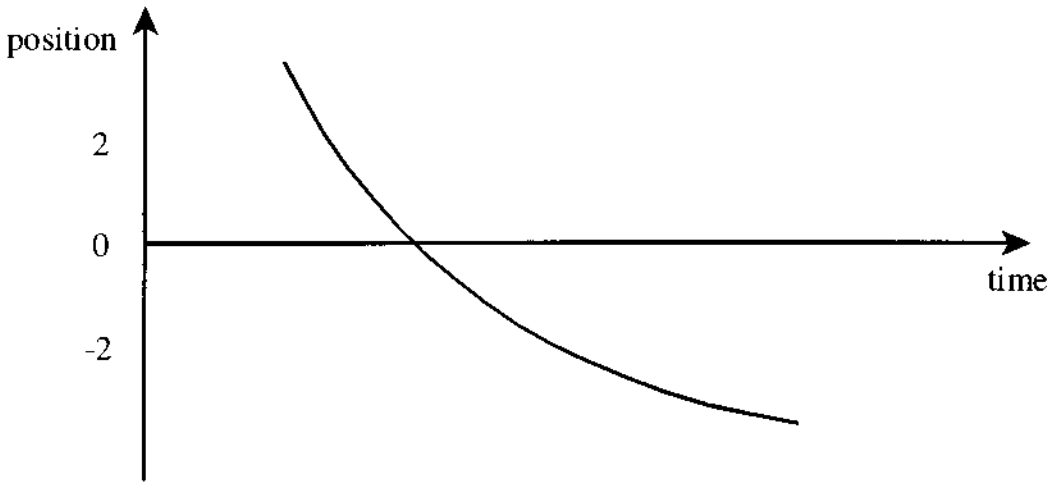
2. A physical quantity q is related to measurable quantities a and b by the equation:

$$q = a/b^3$$

The relative uncertainty in q is:

a) $\Delta a + \Delta b$
b) $\Delta a + 3\Delta b$
c) $\Delta a + (\Delta b)^3$
d) $(\Delta a)/a + (3\Delta b)/b$
e) $(\Delta a)/a - (3\Delta b)/b$

3. An object moves such that its position varies as a function of time as shown in the following graph:



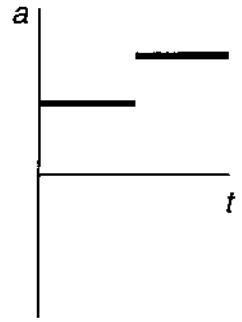
The acceleration of the object

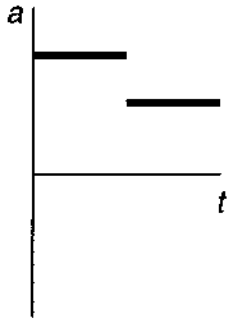
a) is positive.
b) is negative.
c) changes from positive to negative.
d) changes from negative to positive.

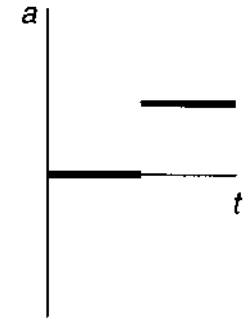
4. A parachutist is falling towards the earth after jumping out of a plane. He soon achieves a constant velocity. Thereafter, he opens his parachute. In the instant after the parachute opens, which of the following statements is true? (Assume that the coordinate system gets more positive with increasing altitude.)

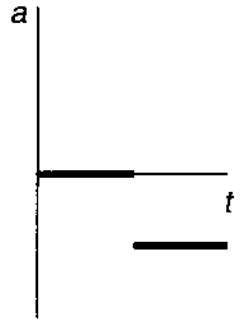
a) His acceleration is positive and his velocity is positive
b) His acceleration is positive and his velocity is negative
c) His acceleration is negative and his velocity is positive
d) His acceleration is negative and his velocity is negative

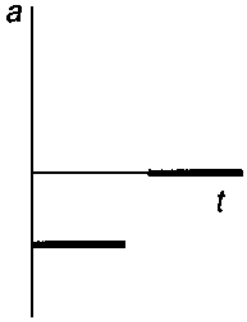
5. There is a system for launching small satellites into outer space that drops the rocket from a plane and, once it has fallen a significant distance from the plane, ignites the rocket's engine. If the altitude coordinate is chosen to increase away from the earth's surface (i.e. in the direction of outer space!) which of the following graphs best describe the acceleration (in the altitude coordinate) of the rocket immediately before and then immediately after the rocket's engine ignites?

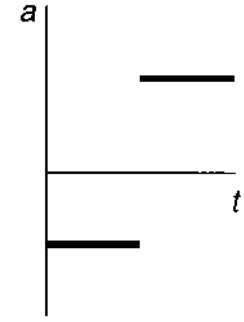
a)


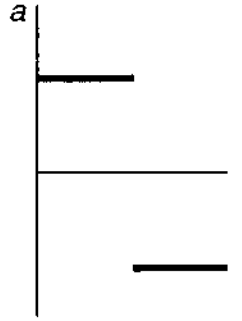
b)


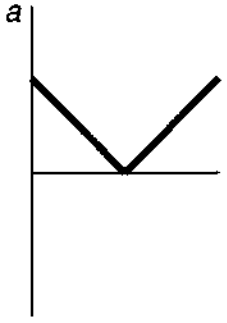
c)


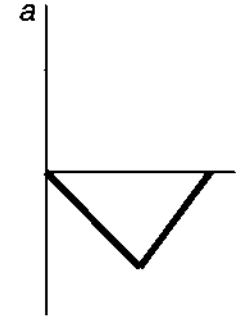
d)


e)


f)


g)


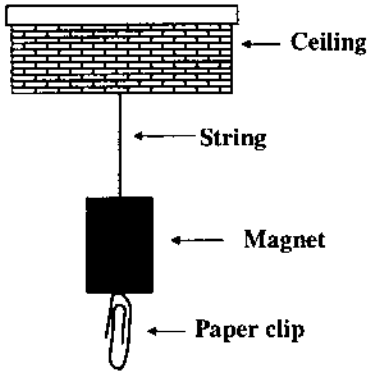
h)


i)


6. A 100 kg alien astronaut awakes after a long space journey to find itself on a planet. In order to estimate its weight before leaving the comfortable confines of its bed, the alien throws an object vertically to a height of 3.0 m. It records the time taken from when the object leaves its weird fingers to when it falls back to them. The duration is 0.96 s. It concludes that its weight is:

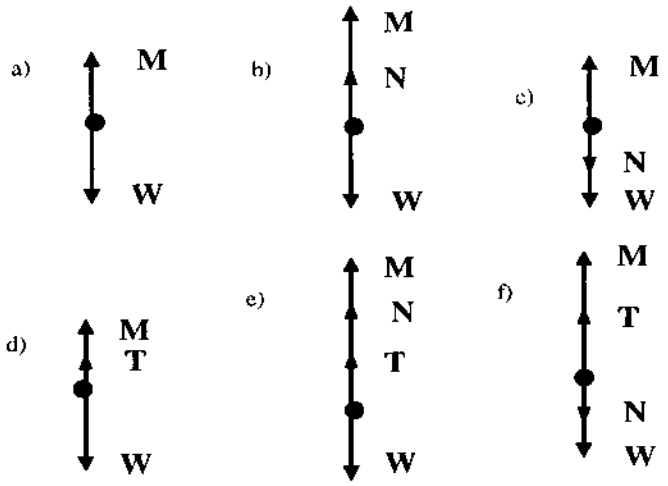
   a) 490 N
   b) 980 N
   c) 1300 N
   d) 2600 N
   e) 5200 N

7. A paper clip hangs from a magnet which is hanging from the ceiling, as shown in the following diagram.



What is the correct free-body diagram of the paper clip?

M is a magnetic force
N is a contact force
T is a tension
W is the gravitational force from the earth



8. When a horse pulls a wagon, the force that causes the horse to move forward is the force:

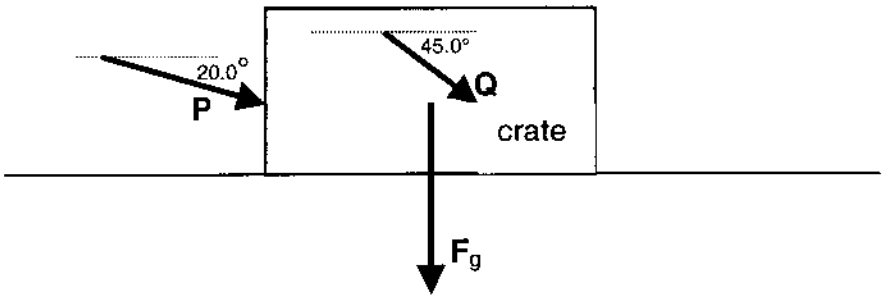
   a) he exerts on the wagon
   b) the wagon exerts on him
   c) he exerts on the ground
   d) the ground exerts on him

9. A horizontal force of 150 N is applied to a 51 kg carton on a level floor. The coefficient of static friction is 0.50 and the coefficient of kinetic friction is 0.40. The magnitude of the frictional force acting on the carton is:

   a) 0 N
   b) 150 N
   c) 200 N
   d) 250 N
   e) 500 N

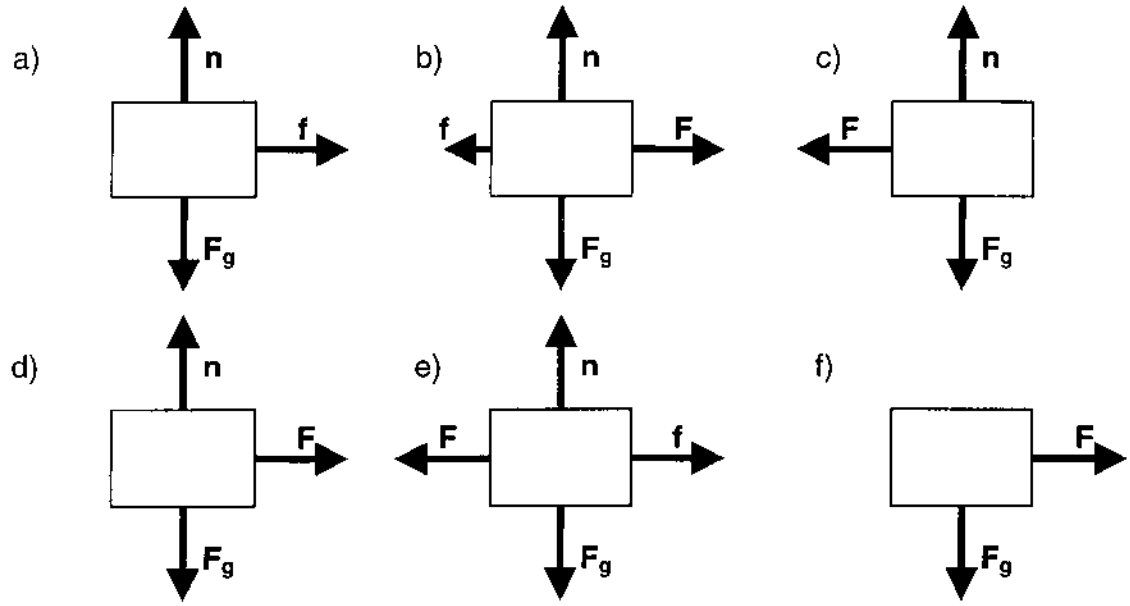
10. A crate of weight $\mathbf{F}_g$ is moved across a floor by a force **P** acting 20.0° below the horizontal and is also acted on by an additional force **Q** at 45.0° below the horizontal in the direction indicated in the diagram. The coefficient of kinetic friction is $\mu_k = 0.400$, the magnitude of $\mathbf{F}_g$ is 20.0 N, the magnitude of **P** is 7.00 N, and the magnitude of **Q** is 12.0 N.

    What is the acceleration of the crate?

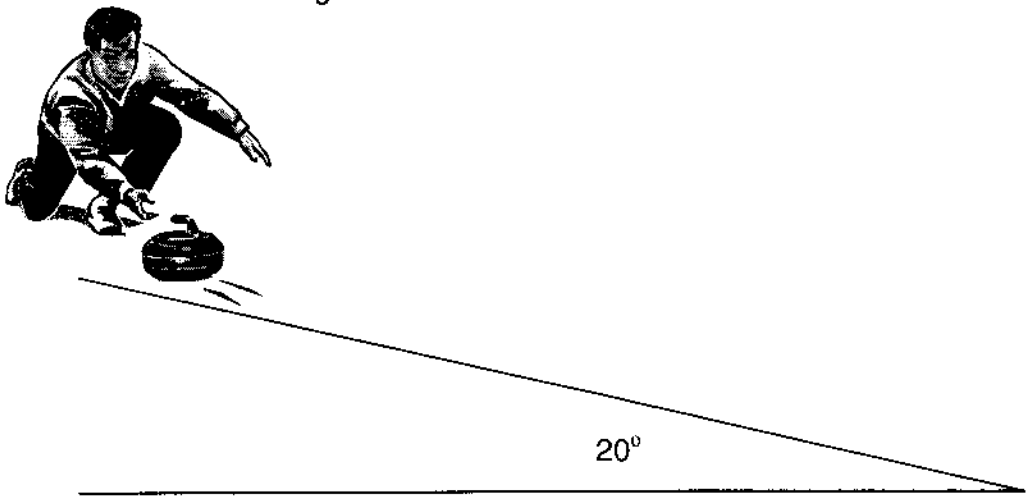


   a) 7.07 m s^{-2} to the right
   b) 3.46 m s^{-2} to the right
   c) 2.71 m s^{-2} to the right
   d) 1.33 m s^{-2} to the right
   e) 0.782 m s^{-2} to the left
   f) None of the above

11. A box is located in the back of a pickup truck. There is static friction between the bottom of the box and the bed of the pickup truck. The truck accelerates to the right. Let f be the frictional force, Fg be the weight, n be the normal force, and F be the force accelerating the pickup truck. Which of the following free-body diagrams correctly describes all of the forces on the box if it does not slide in the bed of the pickup?

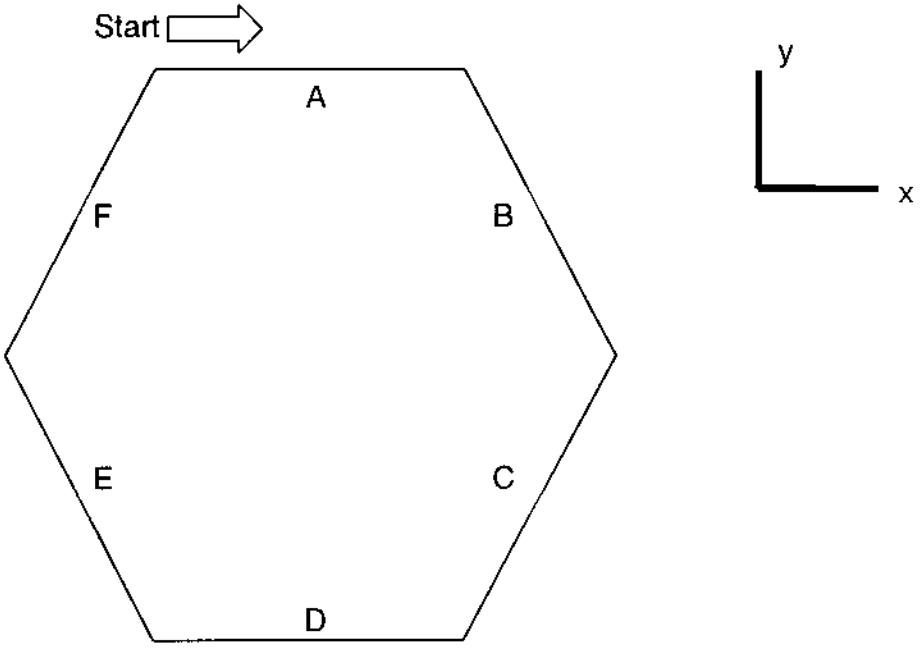


12. An "Extreme Curling" rink has a surface which makes an angle of 20.0° with respect to the horizontal. If stones are released with an initial velocity of 4.00 $m\ s^{-1}$ at the top of the incline, what must the coefficient of kinetic friction be to ensure that it comes to rest at a distance of 10.0 m along the incline?



a) $\mu_k = 0.087$
b) $\mu_k = 0.173$
c) $\mu_k = 0.364$
d) $\mu_k = 0.451$
e) It will continue to accelerate under the stated conditions.

13. A father walks a set of triplets in a baby carriage around a hexagonal city block. At each corner, he turns 60 degrees to his right, eventually ending up where he started. All sides of the hexagon have equal length d, but the magnitude of the force required to push the baby carriage in the direction of motion along sides A and B is 2F, whereas it is F for all the remaining sides.



What work is done?

a) 0 *J*
b) 6dF *J*
c) 8dF *J*
d) 4dF*cos*(60°) + 2dF*sin*(60°) *J*
e) 4dF*sin*(60°) + 2dF*cos*(60°) *J*

14. A simple pendulum swings from its highest position to its lowest position. The forces acting on the suspended mass are the force of gravity, the tension in the supporting cord, and air resistance. Which statements are true?

(Circle 3 answers: one of a-c, one of d-f, one of g-i)

a) gravity does positive work
b) gravity does zero work
c) gravity does negative work
d) tension does positive work
e) tension does zero work
f) tension does negative work
g) air resistance does positive work
h) air resistance does zero work
i) air resistance does negative work

15. Car A is just able to climb a hill of angle 12.0° at a constant speed of 1.00 $m\,s^{-1}$. Car B has the same mass as car A and an engine which can deliver three times the power of Car A. What is the maximum hill angle that Car B can climb at a constant speed of 1.00 $m\,s^{-1}$?

a) 36.0°
b) 38.6°
c) 42.2°
d) 45.0°
e) 51.3°

End of Test