V1

Name:
Student Number:

Lecture Section: **C04 (Hughes)**
C05 (Cockcroft)
C06 (Nejat)

PHY 1B03
Midterm

Winter/13

There are a total of 26 multiple choice question.

Question 1 is the version number and is worth zero

All remaining questions are worth one mark. There is only one correct answer for each question.

Only answers bubbled on the scan card will be marked.

Only the McMaster standard calculator is allowed.

A formula sheet can be found attached to this test paper.

By writing this paper, you agree to be bound by the Senate policy on Academic Dishonesty.

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

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1. This is **version 1** of the test. Choose **1** as the answer to this question. Incorrectly bubbling this answer will adversely affect the marking of your test.

   1.
   2.
   3.
   4.

2. You want to study the effect of viscous drag in the lab. You measure the time it takes for a ball to sink to the bottom of a column of oil. You perform the same measurement 6 times with a stop watch that has a reading uncertainty of .05 s. Your measurements are:

   19.45 s 19.65 s 20.15 s 20.15 s 20.55 s 20.85 s

   What is the **relative uncertainty on the average** of your measurements?

   A. .24 %
   B. 1.5 %
   C. 2.5 %
   D. 3.5 %
   E. 5.0 %

3. The moment of inertia, I, of a rod rotating around one end depends on it mass, M, and its length, L, according to

$$I = \frac{1}{3}ML^2$$

   You measure the mass and length of a particular rod to be 1.30 ± .05 kg and .50 ± .01 m, respectively. What is the moment of inertia of this rod?

   A. .108 ± .006 kg m^2
   B. .108 ± .009 kg m^2
   C. .11 ± .03 kg m^2
   D. .11 ± .05 kg m^2
   E. .11 ± .08 kg m^2

4. A wrecking ball is hanging at rest from a crane when the supporting cable suddenly snaps. The time it takes for the ball to fall halfway to the ground is 2.2 s. The time it takes for the ball to fall **the rest of the way** is

A. .91 s
B. 1.1 s
C. 1.6 s
D. 2.2 s
E. 3.3 s

5. When Jim and Andy ride bicycles, Jim can only accelerate at three quarters the acceleration of Andy. Both start from rest at the bottom of a long straight road with constant upward slope. If Andy takes 5.0 minutes to reach the top, how much earlier should Jim start to reach the top at the same time as Andy?

A. 25 s
B. 40 s
C. 46 s
D. 55 s
E. 75 s

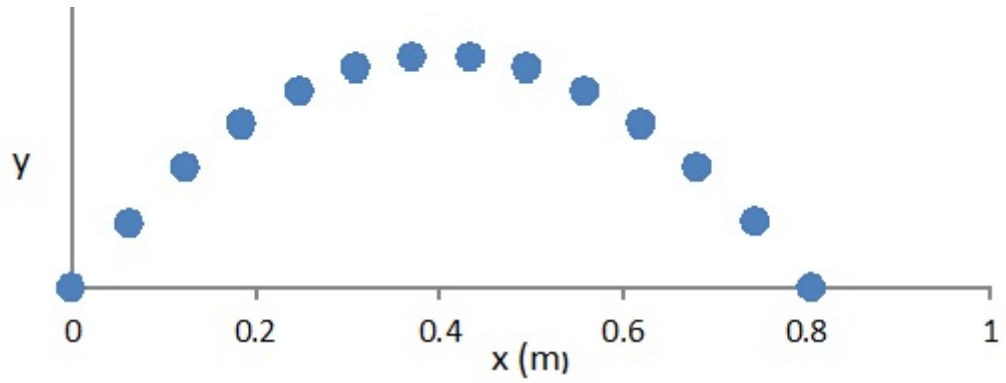
6. Starting at time t = 0, an object moves along a straight line. Its position is given by

$$x(t) = 75\ t - 1.0\ t^3 \quad m$$

where t is in s. At the time that it momentarily comes to rest, what is its acceleration?

A. 0 m/s^2
B. – 18 m/s^2
C. – 30 m/s^2
D. – 42 m/s^2
E. – 88 m/s^2

7. The trajectory of a ball, shown at .040 s intervals, is shown below.



What is the initial velocity of the ball?

A. 1.5 m/s
B. 2.0 m/s
C. 2.5 m/s
D. 3.0 m/s
E. 3.5 m/s

8. A particle moves in the xy plane with a constant acceleration given by

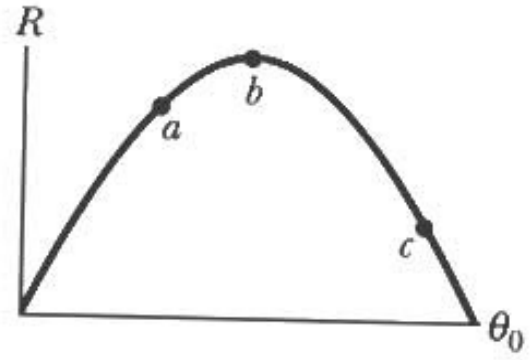
$$\vec{a} = -4.0\,\hat{j} \quad m/s^2$$

At t = 0, its position and velocity are $10\,\hat{i}$ m and $(-2.0\,\hat{i} + 8.0\,\hat{j})$ m/s respectively. What is the distance from the origin to the particle at t = 2.0 s ?

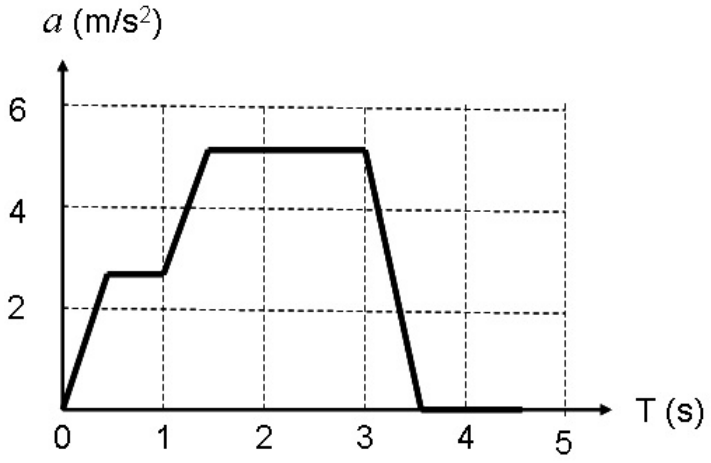
A. 6.4 m
B. 8.9 m
C. 10. m
D. 14. m
E. 16. m

9. A ball is shot from ground level over level ground at a certain initial speed. The figure below gives the range, R, of the ball versus its **launch angle,** θ_0 . Rank the three lettered points on the plot according to the **total flight time** of the ball, greatest first.

A. a, c, b
B. b, a, c
C. b, c, a
D. c, a, b
E. c, b, a

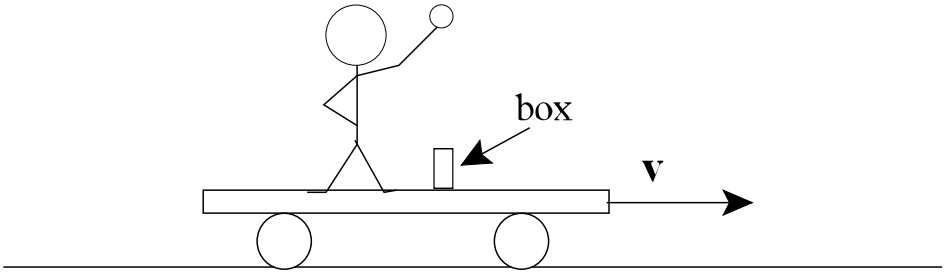


10. The acceleration of an object, starting from rest, is shown below. Besides t = 0 , when is the velocity of the object is zero?

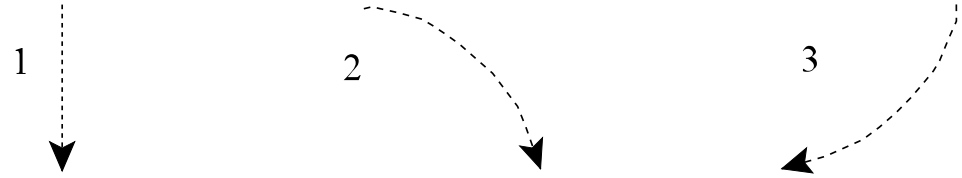


A. During the interval from 0.5 s to 1.0 s.
B. During the interval from 1.5 s to 3.0 s.
C. At t = 3.5 s
D. At t = 4.0 s
E. At no other time less than or equal to 4.5 s

11. Dr. Nejat stands on a platform holding a baseball. Dr. Hughes stands on the ground beside the platform. The platform is rolling to the right at a constant speed relative to Dr. Hughes when Dr. Nejat drops the ball.



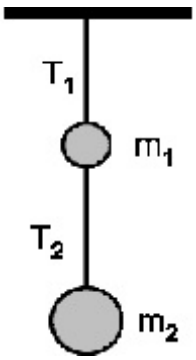
Consider the following possible trajectories for the ball as it is falls.



What does Dr. Hughes see?

A. Trajectory (1). The ball lands in the box.
B. Trajectory (1). The ball lands behind the box.
C. Trajectory (2). The ball lands in the box.
D. Trajectory (2). The ball lands in front of the box.
E. Trajectory (3). The ball lands behind the box.

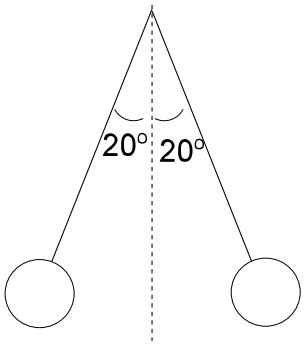
12. Consider the object in the diagram. What is the reaction force (in the Newton's third law sense) of the force exerted by the upper rope on m_1 ?



A. The weight of mass 1.
B. The weight of both masses.
C. The force that m_1 exerts on the lower rope
D. The force that m_1 exerts on the upper rope.
E. The tension in the lower rope.

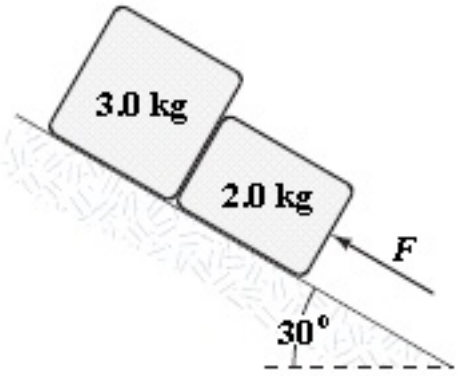
13. You charge two 5.00 g balloons by rubbing them in your hair. When you hang them up, you find that they repel each other, as shown in the diagram below. Calculate the electrostatic force between the balloons. (Assume that it acts along a horizontal line joining the centres of the two balloons.)

A. .0168 N
B. .0178 N
C. .0460 N
D. .134 N
E. .143 N

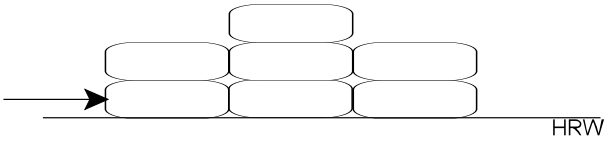


14. The surface of the inclined plane shown is frictionless. If F = 30.0 N, what is the magnitude of the normal force exerted on the 3.00 kg block by the 2.00 kg block?

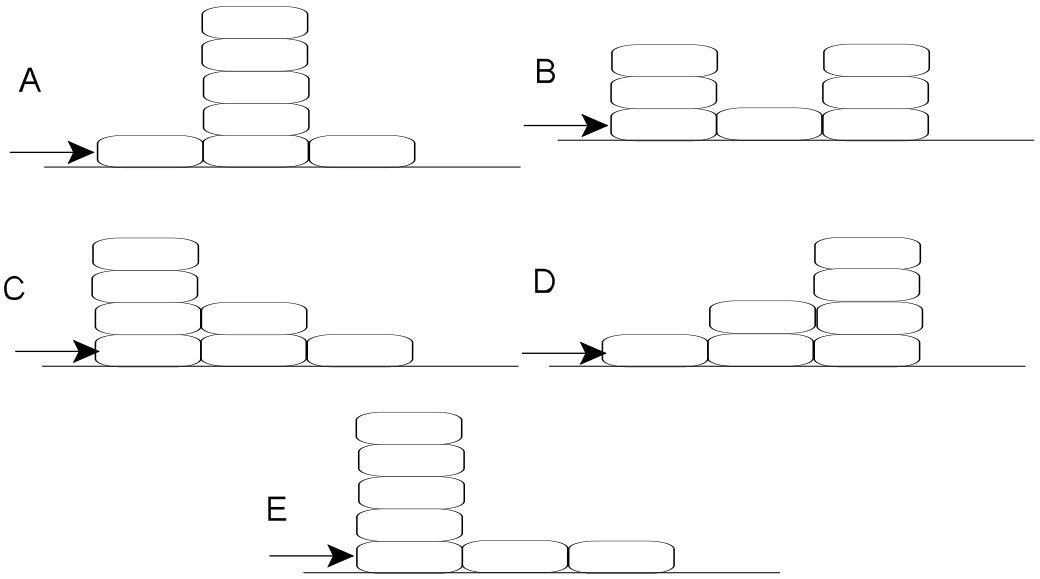
A. 9.80 N
B. 11.4 N
C. 14.7 N
D. 18.0 N
E. 30.0 N



15. You have seven bricks which you intend to stack into 3 columns. (A possible configuration of the stacking is shown in the diagram below.) You are going to push the stack across a frictionless surface with a constant force. There is sufficient friction between the bricks that the stack will maintain the configuration while in motion.



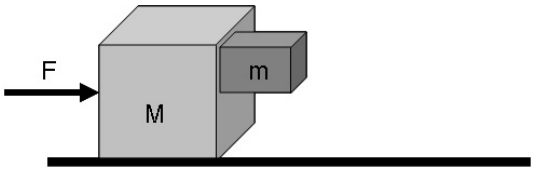
How would you stack the bricks so that the net force on the middle stack is greatest?



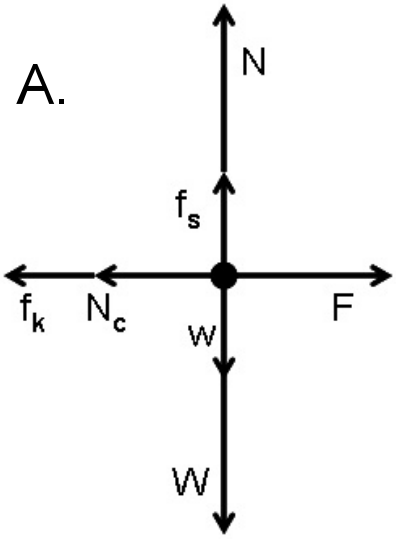
16. The coefficients of kinetic and static friction between a 3.00 kg box and the floor on which it rests are .300 and .400 respectively. If the box is initially at rest, what is the magnitude of the **net** force on the box when a 5.00 N horizontal force is applied?

A. 0 N
B. 3.80 N
C. 6.00 N
D. 6.76 N
E. 11.8 N

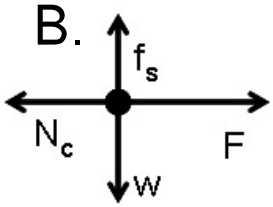
17. A small block of mass m is placed in front of a large block of mass M as shown. The force F is applied to the large box and m does not fall. If the weight of the small block and large block are **w** and **W** respectively, the normal force between them is N_c, the normal force with the horizontal surface is **N**, and the force of friction is f, which of the following is the correct free-body diagram of the small block?



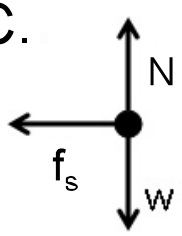
A.



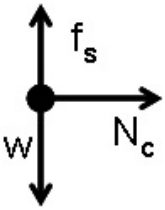
B.



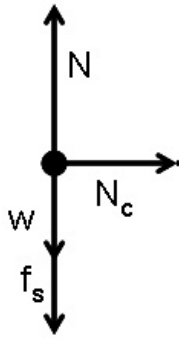
C.



D.

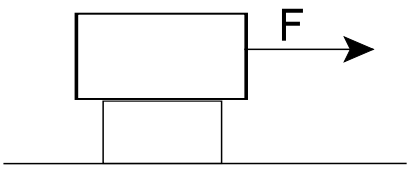


E.



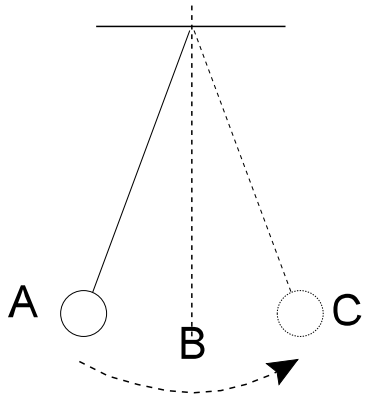
18. A constant horizontal force, F, is applied to a 4.50 kg block which sits on top of a 2.50 kg block. The coefficient of static friction between the two blocks is 0.500. The coefficient of kinetic friction between the lower block and the floor is 0.115. The force F causes the block system to cross some distance, starting from rest, with no slipping between the blocks. If the blocks travels the distance in the least amount of time, what is the force F?

A. 22.1 N
B. 31.2 N
C. 47.5 N
D. 56.7 N
E. 70.0 N



19. Consider the simple pendulum shown in the diagram as it swings from A to C. Which of the following statements is correct? The work done by gravity

A. is positive from A to C
B. is negative from A to C
C. is positive from A to B, and negative from B to C
D. is negative from A to B, and positive from B to C
E. may be positive or negative: it depends on how the positive direction is defined.

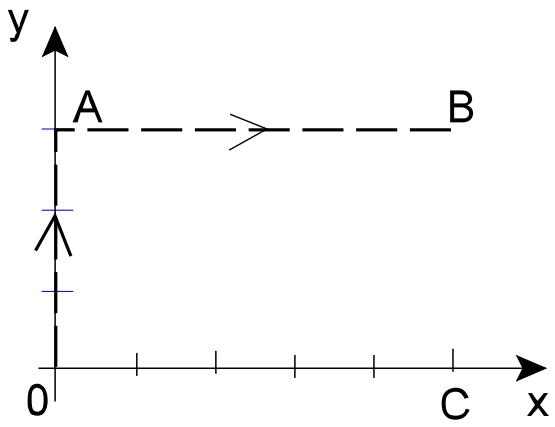


20. A force acting on a particle moving in the xy plane is given by

$$\vec{F} = (2.50, 1.50x)\ \text{N}$$

where x is in meters. The particle moves from the origin to a final position having coordinates x = 5.00 m and y = 3.00 m , along the path 0AB, as shown in the diagram below. Calculate the work done by the force along that path.

A. 7.50 J
B. 12.5 J
C. 17.0 J
D. 18.5 J
E. 37.5 J



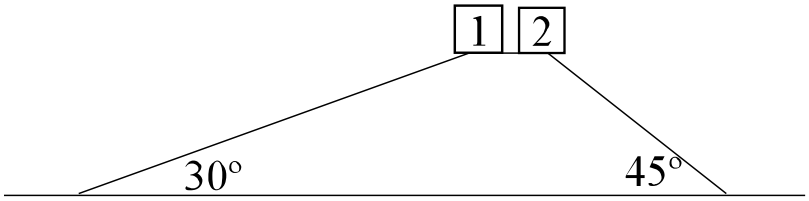
21 Suppose that in the previous problem, the object travels from 0 to B and then back to 0 again. The path taken is 0ABC0. Which of the following statements is correct?

A. Since the work done around the closed loop is zero, the force may be conservative.
B. Since the work done around the closed loop is not zero, the force is not conservative.
C. Since the displacement would be zero, the work done is zero, and so you can't tell whether the force is conservative or not.

22. A 2.0-kg mass swings at the end of a light string (length = 3.0 m). Its speed at the lowest point on its circular path is 6.0 m/s. What is its kinetic energy at an instant when the string makes an angle of 50° with the vertical?

A. 15 J
B. 21 J
C. 23 J
D. 28 J
E. 36 J

23. Two blocks are released simultaneously from the top of a frictionless ramp as shown in the diagram below. Block (1) slides down the side of the ramp that makes an angle of 30° with the horizontal while block (2) slides down the other side, which makes an angle of 45° with the horizontal.

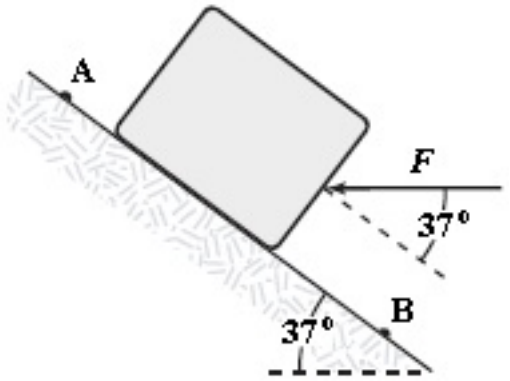


Which of the following statements is correct?

A. Block (1) arrives at the bottom after block (2) and with a greater speed.
B. Block (1) arrives at the bottom after block (2) and with a smaller speed.
C. Block (1) arrives at the bottom after block (2) but with the same speed.
D. The two blocks reach the bottom at the same time and with the same speed.

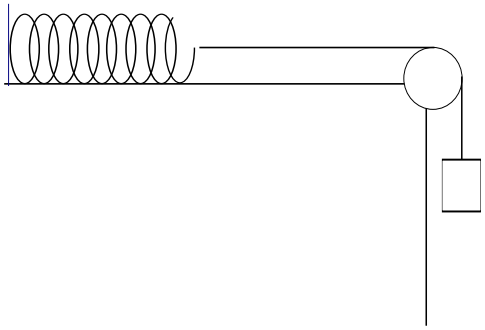
24. A 4.00 kg block is lowered down a 37° incline a distance of 5.00 m from point A to point B. A horizontal force, F, of 10.0 N is applied to the block between A and B as shown in the figure. The kinetic energy of the block at A is 10.0 J and at B it is 20.0 J. How much energy is lost to the force of friction between A and B?

A. 68.0 J
B. 88.0 J
C. 108 J
D. 148 J
E. 167 J

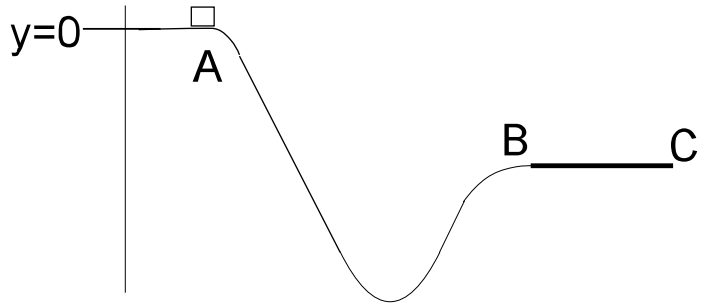


25. An ideal Hooke's law spring (spring constant 250 N/m) is attached to a wall at one end, and to a 2.00 kg hanging block at the other by a light string which passes over a pulley . (See the diagram.) The block is initially held in place by an external force so that the spring is at its natural length. When released, how far will the small block fall before coming (momentarily) to rest?

A 7.84 c m
B. 15.7 cm
C. 20.2 cm
D. 27.4 cm
E. 54.9 cm



26. A block slides from A to B along a frictionless ramp and then passes through a region, B to C, where a frictional force acts on it. (See the diagram.)



Which of the following sketches best describes the mechanical energy of the block as a function of time between A and C?