UNIVERSITY OF MANITOBA

October 13, 2011
(7:00 pm – 9:00 pm)

MID-TERM TEST
(+ Formula Sheet)

PAPER NO.: **A**

DEPARTMENT & COURSE NO.: PHYS 1050

TIME: 2 hours

EXAMINATION: Physics 1: Mechanics

EXAMINERS: F. Lin, C-M. Hu, S. A. Page

All questions are of equal value. Answer all questions. No marks are subtracted for wrong answers.

Record all answers on the computer score sheet provided. **USE PENCIL ONLY!** Black pen will look good but may not be read reliably by the scoring machine. **Mark only <u>one</u> answer for each question!** Select the answer that is closest to yours.

A formula sheet is provided for your use; you may **not** use your own formula sheet or any other materials or notes. Calculators of any type are allowed, but not devices that store text or that can communicate with other such devices.

The value for g should be taken as 9.80 m/s^2 as indicated on the formula sheet except in questions where it is otherwise indicated.

Be sure your name and student number are printed on the score sheet and the student number correctly coded in the box at the top right-hand side of the sheet.

This is paper A. Questions are numbered 1 to 18. Mark the correct answers in rows 1-18 of the ***first*** column of the accompanying IBM sheet in pencil. Also write "Paper A" next to your name on the IBM sheet.

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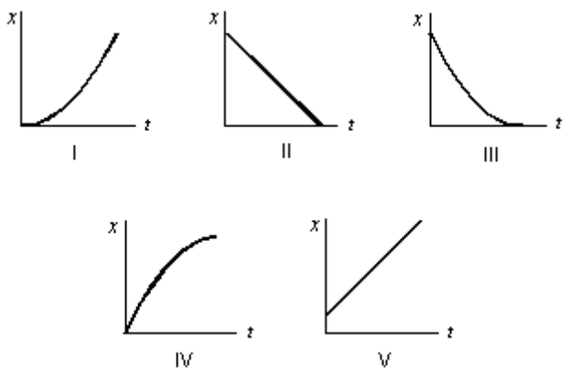
1. Which of the following five coordinate versus time graphs represents the motion of an object whose speed is increasing?



a) I b) II c) III d) IV e) V

2. Newton's law of gravitation states that the attractive force between two bodies of mass m_1 and m_2, a distance r between their centers, is given by: $F = G\frac{m_1 m_2}{r^2}$, where G is the gravitational constant. The SI units of G must be:

a) $kg\,m\,s^{-2}$ b) $m^3\,s^{-2}\,kg^{-1}$ c) $kg\,s^2\,m^{-2}$ d) $kg\,m^2\,s^{-2}$ e) $kg^2\,m^2\,s^{-2}$

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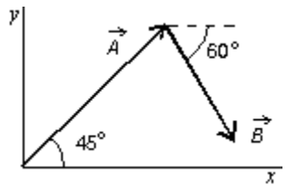
3. In the diagram, $\vec{A}$ has magnitude 12 and $\vec{B}$ has magnitude 8. The *y* component of $(\vec{A}+\vec{B})$ is:



a) 1.6 b) 5.1 c) 7.6 d) 8.0 e) 15

4. A stone falls from rest starting at an unknown height h, and it hits the ground with a speed $v = 30$ m/s. From what height did it fall? (take g = 10 m/s^2 for this question)

a) 1.5 m b) 3 m c) 15 m d) 45 m e) 90 m

5. Two automobiles are 150 kilometers apart and traveling toward each other. One automobile is moving at 60 km/h and the other is moving at 40 km/h. In how many hours will they meet?

a) 2.5 b) 2.0 c) 1.75 d) 1.5 e) 1.25

6. The position of an object is given as a function of time by $x = 4t^2 - 3t^3$, where *x* is in meters and *t* is in seconds. Its average acceleration over the interval from $t = 0$ to $t =$ 2 s is:

   a) –4 m/s^2 b) 4 m/s^2 c) –10 m/s^2 d) 10 m/s^2 e) –13 m/s^2

7. A stone is released from a balloon that is descending at a constant speed of 10 m/s. Neglecting air resistance, after 20 s the speed of the stone is:

   a) 2160 m/s b) 1760 m/s c) 206 m/s d) 196 m/s e) 186 m/s

8. A ball is thrown horizontally from the top of a 20 m high hill. It strikes the ground at an angle of 45^o. Approximately, what is the horizontal distance between the top of the hill and the position where the ball strikes the ground?

a) 20 m b) 40 m c) 80 m d) 160 m e) 10 m

9. A stone is tied to a 2 m string and whirled at a constant speed of 2.0 m/s in a vertical circle. Its acceleration at the bottom of the circle is:

a) 1 m/s^2, up b) 1 m/s^2, down c) 0 m/s^2 d) 2 m/s^2, down e) 2 m/s^2, up

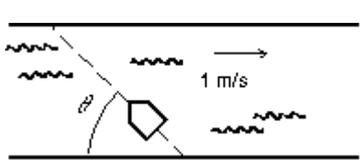
10. The city of Winnipeg rotates in uniform circular motion about the earth's axis, with a radius of 4.10×10^6 m. What is its speed?

a) 0 m/s b) 9.8 m/s c) 95 m/s d) 149 m/s e) 298 m/s

11. A boat is traveling at 20 km/hr (along the direction of the water flow) with respect to a river that is flowing at 6 km/hr (with respect to the ground). A man in the boat runs directly from the back to the front of the boat at 6 km/hr (with respect to the boat). The speed of the man with respect to the ground is:

a) 32 km/hr b) 20 km/hr c) 12 km/hr d) 6 km/hr e) 26 km/hr

12. A boy wishes to row across a river via the shortest possible path. He can row at 2 m/s in still water, and the river is flowing at 1 m/s. At what angle θ should he point the front of his boat?

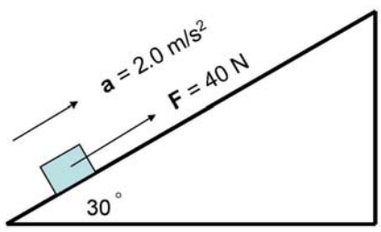


a) 30° b) 45° c) 60° d) 75° e) 90°

13. Two forces are applied to a 5.0-kg crate which sits on a frictionless horizontal surface; one force is 6.0N to the north and the other force is 8.0N to the west. The magnitude of the acceleration of the crate is:

a) 0.50 m/s^2 b) 2.0 m/s^2 c) 2.8 m/s^2 d) 10 m/s^2 e) 50 m/s^2

14. When a force F=40N is applied to a crate on a frictionless incline that is 30° above the horizontal, as shown, the acceleration of the crate is 2.0 m/s^2, up the incline. The mass of the crate is:

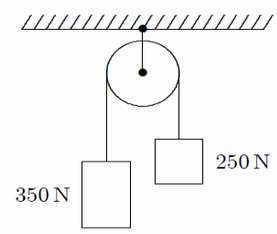


a) 3.8 kg b) 4.1 kg c) 5.8 kg d) 6.2 kg e) 10 kg

15. A 5-kg concrete block is lowered with a downward acceleration of 2.8 m/s^2 by means of a rope. The tension force exerted by the rope on the block is:

a) 14 N, up b) 14 N, down c) 35 N, up d) 35 N, down e) 49 N, up

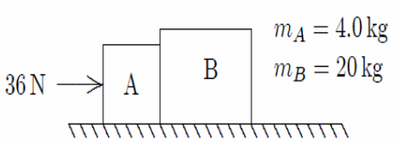
16. Two blocks, weighing 250 N and 350 N, respectively, are connected by a string that passes over a massless pulley as shown. The tension in the string is (choose the closest answer):



a) 210 N b) 290 N c) 410 N d) 500 N e) 4900 N

17. Two blocks (A and B) are in contact on a horizontal frictionless surface. A 36-N constant force is applied to A as shown. The magnitude of the force of A on B is:

a) 1.5 N b) 6.0 N c) 25 N d) 30 N e) 36 N



18. Acceleration is always in the direction:

a) of the displacement
b) of the initial velocity
c) of the final velocity
d) of the net force
e) opposite to the frictional force