UNIVERSITY OF MANITOBA

October 14, 2010
(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, G. Williams

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. A motor boat can travel at 10 km/h in still water. A river flows at 5 km/h west. A boater wishes to cross from the south bank to a point directly opposite on the north bank. At what angle must the boat be headed?

   (a) 27^o E of N (b) 30^o E of N (c) 45^o E of N (d) 60^o E of N
   (e) depends on the width of the river

2. Two projectiles are in flight at the same time. The acceleration of one relative to the other:

   (a) is always 9.8 m/s^2 (b) can be as large as 19.8 m/s^2 (c) can be horizontal
   (d) is zero (e) none of these

3. A lead block is suspended from your hand by a string. The reaction to the force of gravity on the block is the force exerted by:

   (a) the string on the block (b) the block on the string (c) the string on the hand
   (d) the hand on the string (e) the block on Earth

4. A 25-kg crate is pushed across a frictionless horizontal floor with a force of 20 N, directed 20^o below the horizontal. The acceleration of the crate is:

   (a) 0.27 m/s^2 (b) 0.75 m/s^2 (c) 0.80 m/s^2 (d) 170 m/s^2 (e) 470 m/s^2

5. A block slides down a frictionless plane that makes an angle of 30^o with the horizontal. The acceleration of the block is:

   (a) 9.80 m/s^2 (b) 5.66 m/s^2 (c) 8.49 m/s^2 (d) zero (e) 4.90 m/s^2

6. A 5-kg concrete block is lowered with a downward acceleration of 2.8 m/s^2 by means of a rope.

   The force of the block on the rope is:

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

7. The position vector $\vec{r}(t)$ (in m) for a particle moving in the (*x*-*y*) plane is given by:

$$\vec{r}(t) = (6t - 1)\hat{i} + (3t^2 - 2t)\hat{j}$$

   (where *t* is in s). What is the *x*-coordinate of this particle when the *y*-component of its (instantaneous) velocity is zero:

   (a) 0 (b) 2 m (c) 4 m (d) 3 m (e) 1 m

8. A particle moves counter clockwise in the (*x*-*y*) plane around a circular path of fixed radius about the origin. It has a constant speed of $\pi/2$ m/s. At time *t*=0 it is located at (*x*=3, *y*=0) m. What is the <u>average</u> acceleration of this particle over the time interval t_1 = 0s to t_2 = 9s:

   (a) 0 m/s^2 (b) $\frac{\pi}{12}\hat{i}$ m/s^2 (c) $\frac{\pi}{9}(\hat{i} - 2\hat{j})$ m/s^2 (d) $\frac{\pi}{18}(\hat{i} - \hat{j})$ m/s^2

   (e) $\frac{\pi}{6}(2\hat{i} - \hat{j})$ m/s^2

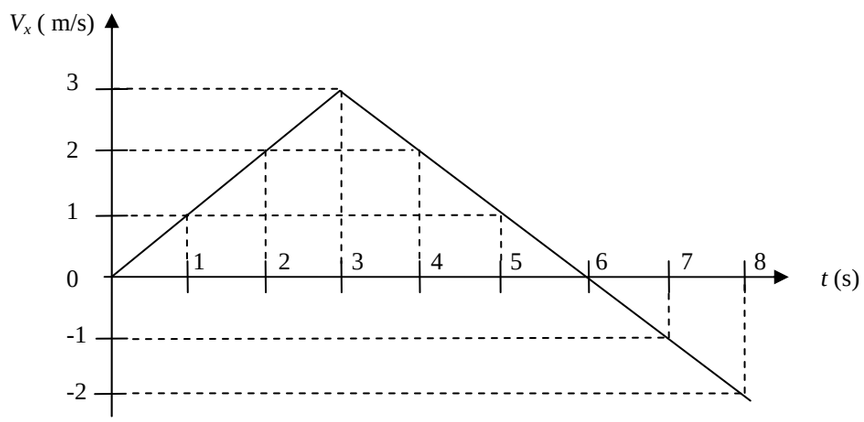
9. A truck and a car, both moving in a straight line, start from rest at the same time. The truck accelerates at 4m/s^2 for 20s, while the car accelerates at 8m/s^2 for 10s and then moves at constant speed. At the end of 20s, the ratio of the distance travelled by the truck compared to that travelled by the car is:

   (a) 1 (b) 2 (c) $\frac{3}{4}$ (d) $\frac{3}{2}$ (e) $\frac{2}{3}$

10. In 3s, a particle moving with constant acceleration along the *x*-axis goes from *x*=10m to *x*=73m. At the end of this time interval the velocity of the particle is 15 m/s. The acceleration of this particle is

    (a) +15 m/s^2 (b) -20 m/s^2 (c) -8 m/s^2 (d) -10 m/s^2 (e) -4 m/s^2

11. The velocity of v_x of a particle moving along the x-axis is shown in the accompanying figure.



If this particle is at x = 2m at time t = 2s, what is the position of the particle at time t = 8s (Hint, a graphical approach is easiest)

(a) -2 m (b) 2 m (c) 4 m (d) 6 m (e) 7 m

12. The position vector, $\vec{r}(t)$ (in m), of a particle moving in the (x-y) plane is given by:

$$\vec{r}(t) = (5 - 4t^3)\hat{i} + (10 + 2t^2)\hat{j}$$

(where t is in s). At time t = 2s, the angle the instantaneous velocity vector makes with the positive x-direction (measured counter clockwise) is:

(a) 190° (b) 171° (c) 80° (d) 9° (e) 280°

13. A car rounds a 15-m radius curve at 10 m/s. The magnitude of its acceleration is:

(a) 0 (b) 0.667 m/s^2 (c) 6.67 m/s^2 (d) 40 m/s^2 (e) 400 m/s^2

14. A girl jogs around a horizontally circle with a constant speed. She travels one fourth of a revolution, a distance of 25 m along the circumference of the circle, in 5.0 s. The magnitude of her acceleration is:

(a) 0.31 m/s^2 (b) 1.3 m/s^2 (c) 1.6 m/s^2 (d) 3.9 m/s^2 (e) 6.3 m/s^2

15. A projectile is fired over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. Using g = 10 m/s^2, the distance from launching to landing points is:

(a) 40 m (b) 60 m (c) 80 m (d) 120 m (e) 180 m

16. A boy on the edge of a vertical cliff 20 m high throws a stone horizontally outwards with a speed of 20 m/s. It strikes the ground at what horizontal distance from the foot of the cliff? Use g = 10 m/s^2

(a) 10 m (b) 40 m (c) 50 m (d) $50\sqrt{5}$ m (e) none of these

17. Identical guns fire identical bullets horizontally at the same speed from the same height above level planes, one on the Earth and one on the Moon. Which of the following three statements is/are true?

I. The horizontal distance traveled by the bullet is greater for the Moon.
II. The flight time is less for the bullet on the Earth.
III. The velocities of the bullets at impact are the same.

(a) III only (b) I and II only (c) I and III only (d) II and III only
(e) I, II, III

18. An object is moving on a circular path of radius π meters at a constant speed of 4.0 m/s. The time required for half revolution is:

(a) $4/\pi^2$ s (b) $\pi^2/4$ s (c) $\pi/4$ s (d) $\pi^2/8$ s (e) $4/\pi$ s

THE END