

UNIVERSITY OF MANITOBA

October 16, 2014
(7:00 pm – 9:00 pm)

MID-TERM TEST
(+ Formula Sheet)

PAPER NO.: **A**

PAGE NO.: 1 of 4

DEPARTMENT & COURSE NO.: PHYS 1050

TIME: 2 hours

EXAMINATION: Physics 1: Mechanics

EXAMINERS: J. Sirker, F. Lin, C.-M. Hu

All questions are of equal value. Answer all questions. No marks are subtracted for wrong answers. Scrap paper is provided for your rough work.

Record all answers on the computer score sheet provided. **USE PENCIL ONLY! Mark only one answer for each question!** Select the answer, after appropriate rounding, 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.

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.

1. The position of a particle is given by

$$x(t) = \frac{1}{3}t^3 - 2t^2 + 5$$

x is in meters and t is in seconds. What is its average acceleration over the time interval $t = 1\text{s}$ to $t = 3\text{s}$?

- (a) 2 m/s² (b) -2 m/s² (c) 4 m/s² (d) 0 m/s² (e) -4 m/s²

2. A skier hits a 50 cm wide patch with sparse snow coverage. He can keep his balance but his velocity is reduced from 30 km/h to 25 km/h. How large is the acceleration (assumed to be constant) he experiences?

- (a) 21 m/s² (b) -21 m/s² (c) 11 m/s² (d) -11 m/s² (e) -16 m/s²

3. To a vector $\vec{a} = 2\hat{i} - 6\hat{j} + 12\hat{k}$ the vector $4\vec{b}$ is added yielding the vector $\vec{s} = 6\hat{i} + 2\hat{j} - 4\hat{k}$. What is \vec{b} ?

- (a) $\vec{b} = -\hat{i} - 2\hat{j} + 4\hat{k}$
 (b) $\vec{b} = 2\hat{i} + 4\hat{j} - 6\hat{k}$
 (c) $\vec{b} = 4\hat{i} + \hat{j} + 2\hat{k}$
 (d) $\vec{b} = -\hat{i} - \hat{j} + \hat{k}$
 (e) $\vec{b} = \hat{i} + 2\hat{j} - 4\hat{k}$

4. A hiker walks for 10 km in a direction of 20° east of north and then for another 15 km in a direction of 20° west of north. How far north of his starting point does he finish his hike?

- (a) 19 km (b) 26 km (c) 23 km (d) 16 km (e) 21 km

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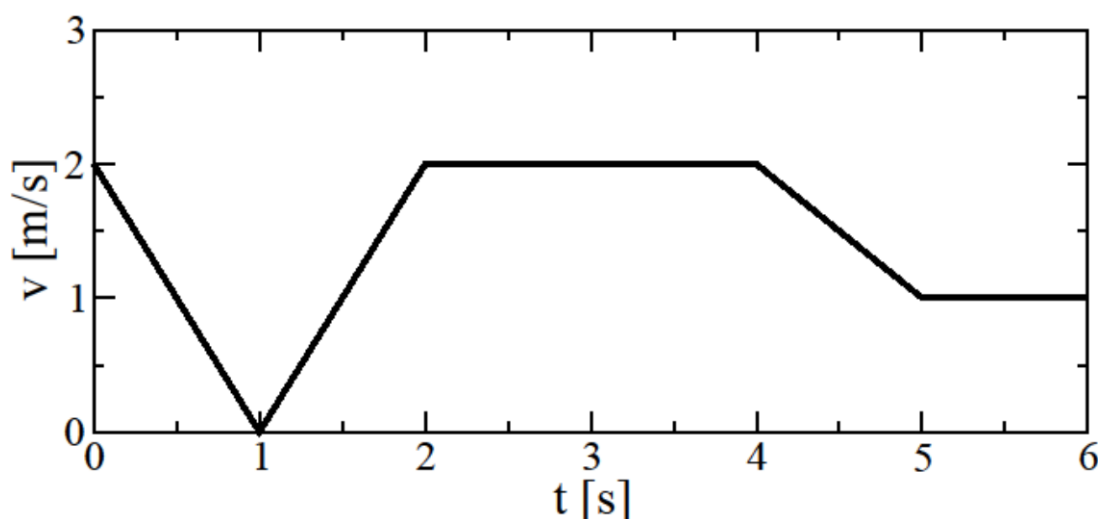
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5. The position of a particle is given by

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

At time $t = 2$ s the angle the acceleration of the particle makes with the positive x-axis is given by?

- (a) 79.5° (b) 179.5° (c) 279.5° (d) 169.5° (e) 269.5°
6. The velocity of a particle moving along the x-axis is shown in the following figure



How large is the displacement of the particle at time $t = 6$ s from its initial position at $t = 0$ s?

- (a) 4.5 m (b) 5.5 m (c) 6.5 m (d) 7.5 m (e) 8.5 m
7. An object moves from $x_0 = -2.1$ m, $y_0 = 3.7$ m, $z_0 = 1.4$ m to $x = 3.3$ m, $y = -1.1$ m, $z = 4.2$ m in a time of 5.3 s. What is its average velocity?
- (a) $(0.23 \text{ m/s}) \hat{i} + (0.49 \text{ m/s}) \hat{j} + (0.53 \text{ m/s}) \hat{k}$
 (b) $(5.4 \text{ m/s}) \hat{i} - (4.8 \text{ m/s}) \hat{j} + (2.8 \text{ m/s}) \hat{k}$
 (c) $(1.0 \text{ m/s}) \hat{i} - (0.91 \text{ m/s}) \hat{j} + (0.53 \text{ m/s}) \hat{k}$
 (d) $(1.0 \text{ m/s}) \hat{i} + (0.91 \text{ m/s}) \hat{j} + (1.1 \text{ m/s}) \hat{k}$
 (e) $-(1.0 \text{ m/s}) \hat{i} + (0.91 \text{ m/s}) \hat{j} + (0.53 \text{ m/s}) \hat{k}$
8. An object is shot from the back of a railroad flatcar moving at 40 km/h on a straight horizontal road. The launcher is aimed upward, perpendicular to the bed of the flatcar. If there is no drag force then the object falls:
- (a) in front of the flatcar
 (b) behind the flatcar
 (c) on the flatcar
 (d) either behind or in front of the flatcar, depending on the initial speed of the object
 (e) to the side of the flatcar

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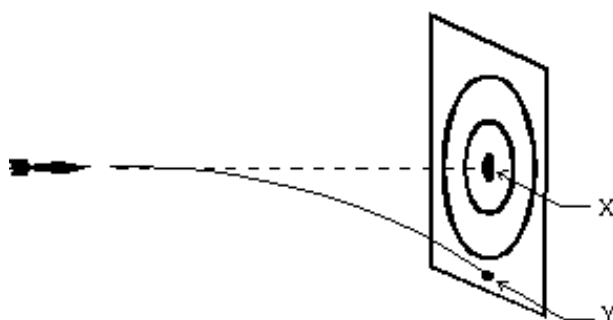
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9. A boy on the edge of a vertical cliff 20 m high throws a stone with a speed of 20 m/s at an angle of 30° upwards with respect to the horizontal. Approximately, it strikes the ground at what horizontal distance from the foot of the cliff?

(a) 10 m (b) 40m (c) 50 m (d) 57 m (e) 70 m

10. A dart is thrown horizontally toward the target X at 20 m/s and hits Y 0.05 m below X (i.e. $XY=0.05\text{m}$). If the target X is moved 2 times the distance away from the position where the dart is thrown and the dart is again thrown horizontally toward the target X at 20 m/s, where will the dart hit (i.e. how will XY change)?

(a) XY is reduced to 0.025 m
(b) XY is reduced to 0.012 m
(c) XY does not change
(d) XY is increased to 0.1 m
(e) XY is increased to 0.2 m



11. A stone is tied to a 1.5 m string and whirled at a constant speed of 2.0 m/s in a vertical circle. Its acceleration at the top of the circle is:

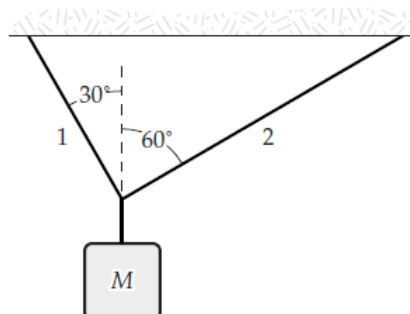
(a) 9.8 m/s^2 , up
(b) 9.8 m/s^2 , down
(c) 8.0 m/s^2 , down
(d) 2.7 m/s^2 , up
(e) 2.7 m/s^2 , down

12. A ship can travel at 10 km/h in still water. The water in the lake flows at 6 km/h west. If the ship wants to cross from the north bank to a point directly opposite on the south bank, at what angle must the ship be headed?

(a) 20° E of S (b) 37° E of S (c) 45° E of S (d) 53° E of S (e) 60° E of S

13. If $M = 6.0 \text{ kg}$, what is the tension in string 1?

(a) 39 N
(b) 34 N
(c) 29 N
(d) 44 N
(e) 51 N



14. The only two forces acting on a body have magnitudes of 20 N and 35 N and directions that differ by 80° . The resulting acceleration has a magnitude of 20 m/s^2 . What is the mass of the body?

(a) 2.4 kg (b) 2.2 kg (c) 2.7 kg (d) 3.1 kg (e) 1.5 kg

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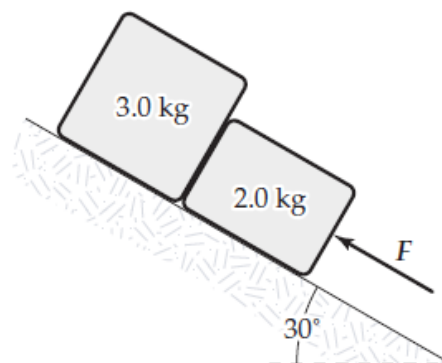
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15. The tension in a massless string from which a 4.0-kg object is suspended in an elevator is equal to 44 N. What is the acceleration of the elevator (assume $g=9.80 \text{ m/s}^2$ is constant)?

- (a) 11 m/s^2 upward
- (b) 1.2 m/s^2 upward
- (c) 1.2 m/s^2 downward
- (d) 10 m/s^2 upward
- (e) 2.4 m/s^2 downward

16. The surface of the inclined plane shown is frictionless. If $F = 30 \text{ N}$, what is the magnitude of the force exerted on the 3.0-kg block by the 2.0-kg block?

- (a) 18 N
- (b) 27 N
- (c) 24 N
- (d) 21 N
- (e) 15 N



17. In a game of shuffleboard (played on a horizontal surface), a puck is given an initial speed of 6.0 m/s. It slides a distance of 9.0 m before coming to rest. What is the coefficient of kinetic friction between the puck and the surface?

- (a) 0.20
- (b) 0.18
- (c) 0.15
- (d) 0.13
- (e) 0.27

18. A 0.50-kg mass attached to the end of a string swings in a vertical circle (radius = 2.0 m). When the string is horizontal, the speed of the mass is 8.0 m/s. What is the magnitude of the force of the string on the mass at this position?

- (a) 16 N
- (b) 17 N
- (c) 21 N
- (d) 11 N
- (e) 25 N