UNIVERSITY OF MANITOBA

October 18, 2012
(7:00 pm – 9:00 pm)
PAPER NO.: **A**

MID-TERM TEST
(+ Formula Sheet)
PAGE NO.: 1 of 5

DEPARTMENT & COURSE NO.: PHYS 1020

TIME: 2 hours

EXAMINATION: General Physics 1

EXAMINERS: R. Cameron, W. Ens
A. Shalchi

All questions are of equal value. 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 which is closest to yours.

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

Unless the question specifically asks about significant figures, an answer should NOT be considered to be incorrect if the number of significant figures does not match the significant figures supplied in the question.

"n.o.t." means "none of these".

Be sure your name and 7-digit student number are printed on the score sheet and your student number is correctly coded in the box at the top right-hand side of the sheet.

This is paper A. Questions are numbered 1 to 20. Mark the correct answers in rows 1-20 of the accompanying IBM sheet in pencil. Also write "Paper A" next to your name on the IBM sheet.

TABLE OF CONSTANTS

$G = 6.673\times10^{-11}\ \text{m}^3\text{kg}^{-1}\text{s}^{-2}$

Mass of the earth $= 5.98\times10^{24}$ kg

$g = 9.8\ \text{m/s}^2$

1 tonne $= 10^3$ kg

Radius of the earth $= 6.38\times10^3$ km

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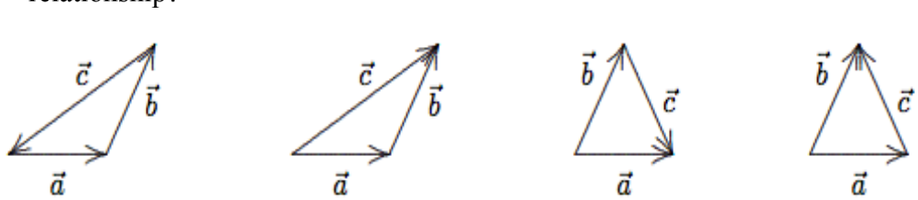
1. The surface of a lake has an area of 15.5 km^2. What is the area of the lake in m^2?

   (a) $1.55\times10^4\ \text{m}^2$ (b) $1.55\times10^5\ \text{m}^2$ (c) $1.55\times10^6\ \text{m}^2$ (d) $1.55\times10^7\ \text{m}^2$ (e) $1.55\times10^8\ \text{m}^2$

2. Three vectors, $\vec{A}, \vec{B}$, and $\vec{C}$ add together to yield zero: $\vec{A}+\vec{B}+\vec{C}=0$. The vectors $\vec{A}$ and $\vec{C}$ point in the same direction and their magnitudes are related by the expression: $A = 2C$. Which one of the following conclusions is correct?

   (a) $\vec{A}$ and $\vec{B}$ have equal magnitudes and point in opposite directions.
   (b) $\vec{B}$ and $\vec{C}$ have equal magnitudes and point in the same direction.
   (c) $\vec{B}$ and $\vec{C}$ have equal magnitudes and point in opposite directions.
   (d) $\vec{A}$ and $\vec{B}$ point in the same direction, but $\vec{A}$ has twice the magnitude of $\vec{B}$.
   (e) $\vec{B}$ and $\vec{C}$ point in opposite directions, but $\vec{C}$ has one third the magnitude of $\vec{B}$.

3. The vectors $\vec{a}, \vec{b}$, and $\vec{c}$ are related by $\vec{c} = \vec{b} - \vec{a}$. Which diagram below illustrates this relationship?



(a) (b) (c) (d) (e) n.o.t.

4. The minimum takeoff speed for a certain airplane is 75 m/s. What minimum acceleration is required if the plane must leave a runway of length 1050 m? Assume the plane starts from rest at one end of the runway.

   (a) 1.5 m/s^2 (b) 3.0 m/s^2 (c) 4.5m/s^2 (d) 6.0 m/s^2 (e) 2.7 m/s^2

5. Ball A is dropped from rest from a window. At the same instant, ball B is thrown downward; and ball C is thrown upward from the same window. Which statement concerning the balls after their release is necessarily true if air resistance is neglected?

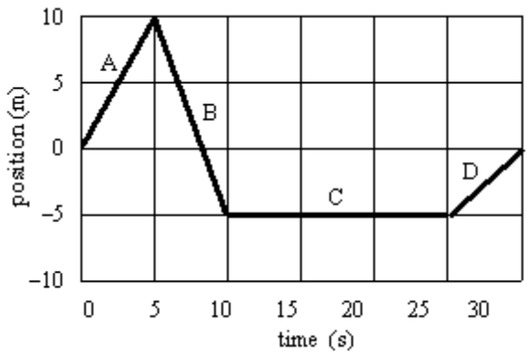
   (a) At some instant after it is thrown, the acceleration of ball C is zero.
   (b) All three balls strike the ground at the same time.
   (c) All three balls have the same velocity at any instant.
   (d) All three balls have the same acceleration at any instant.
   (e) All three balls reach the ground with the same velocity.

6. A fox is walking at a speed of 0.575 m/s when it observes a hen 43.0 m directly ahead. If the fox accelerates at 2.31 m/s^2, how long does it take the fox to reach the hen if the hen doesn't move?

   (a) 8.58 s (b) 7.34 s (c) 6.10 s (d) 3.88 s (e) 5.86 s

7. An object is moving along the *x* axis. The graph shows its position from the starting point as a function of time. What is the velocity of the object at t = 7.0 s?

   (a) +3.0 m/s
   (b) -1.0 m/s
   (c) -2.0 m/s
   (d) -3.0 m/s
   (e) zero m/s



8. A car travels due east at 22 m/s for 60 s. It makes a turn due south and continues to travel at 22 m/s for 120 s. What is the average velocity of the car?

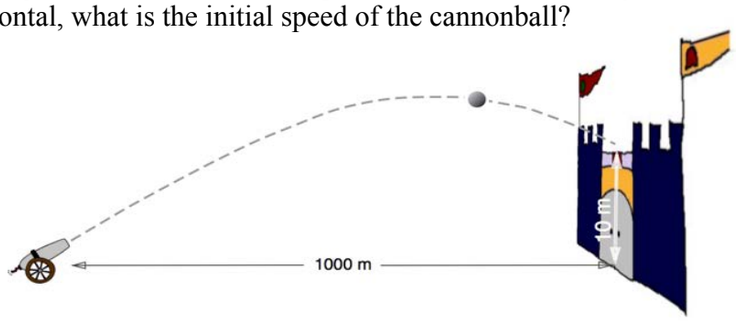
   (a) 22 m/s, due east
   (b) 22 m/s, due south
   (c) 31 m/s, 45º south of west
   (d) 16 m/s, 63º south of east
   (e) 11 m/s, 63º south of east

9. An eagle is flying due east at 8.9 m/s carrying a gopher in its talons. The gopher manages to break free at a height of 12 m. What is the magnitude of the gopher's velocity as it reaches the ground? Ignore effects of air resistance.

   (a) 22 m/s (b) 18 m/s (c) 14 m/s (d) 9.8 m/s (e) 8.9 m/s

10. A cannonball is fired so that it just clears a wall 10 m high a distance 1000 m away. If it is aimed at 30º above the horizontal, what is the initial speed of the cannonball?

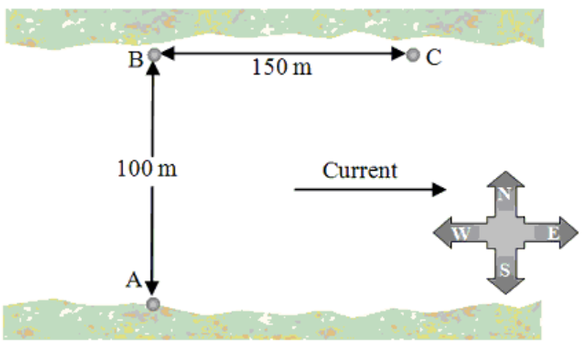
    (a) 35 m/s
    (b) 107 m/s
    (c) 238 m/s
    (d) 343 m/s
    (e) 11 km/s



11. A man at point A directs his rowboat due north toward point B, straight across a river of width 100 m. The river current is due east. The man starts across, rowing steadily at 0.75 m/s and reaches the other side of the river at point C, 150 m downstream from his starting point.

    What is the speed of the river?

    (a) 0.38 m/s
    (b) 0.67 m/s
    (c) 1.1 m/s
    (d) 6.7 m/s
    (e) 7.5 m/s

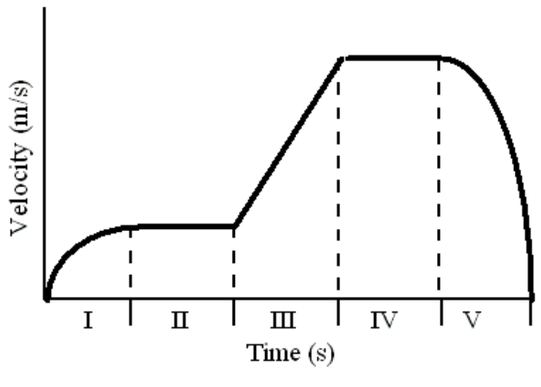


12. Complete the following statement: The term *net force* most accurately describes

    (a) the mass of an object
    (b) the inertia of an object.
    (c) the quantity that causes a displacement.
    (d) the quantity that keeps an object moving.
    (e) the quantity that changes the velocity of an object.

13. A 2.0-kg object moves in a straight line on a horizontal frictionless surface. The graph shows the velocity of the object as a function of time. The various equal time intervals are labeled using Roman numerals: I, II, III, IV, and V. The net force on the object always acts along the line of motion of the object. Which section of the graph corresponds to the application of the *largest constant* net force?

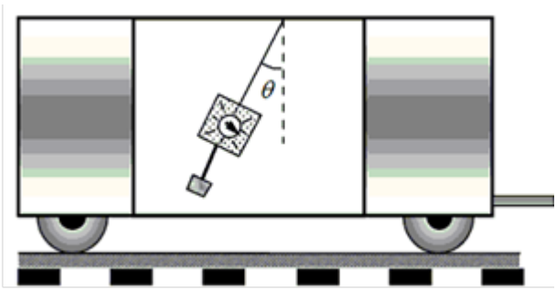
    (a) I
    (b) II
    (c) III
    (d) IV
    (e) V



14. Two forces act on a 20-kg object. The first force has a magnitude of 70 N and is directed 20° north of east. The second force is 30 N, 50° north of west. What is the acceleration of the object resulting from the application of these two forces to the object?

    (a) 1.6 m/s^2, 5.5° north of east
    (b) 1.9 m/s^2, 18° north of west
    (c) 2.4 m/s^2, 34° north of east
    (d) 3.3 m/s^2, 45° north of east
    (e) 4.1 m/s^2, 52° north of east

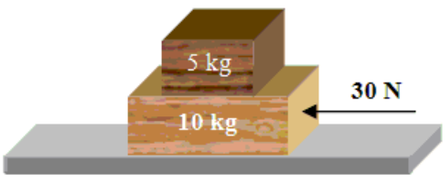
15. A spring scale is fastened to the ceiling of a railway car. When a 1.0-kg block is hung from the scale, it reads 12 N and is oriented as shown in the figure.

    What is the approximate acceleration of the car as measured by an observer at rest on the ground outside of the car?

    (a) 7 m/s^2 to the right
    (b) 7 m/s^2 to the left
    (c) 12 m/s^2 to the right
    (d) 12 m/s^2 to the left
    (e) It is impossible to calculate since the angle θ has not been given.

16. Two blocks rest on a horizontal *frictionless* surface as shown. The surface between the top and bottom blocks is roughened so that there is no slipping between the two blocks. A 30-N force is applied to the bottom block as suggested in the figure. What is the force of static friction between the top and bottom blocks?

    (a) zero Newtons (b) 10 N (c) 20 N (d) 25 N (e) 30 N

17. A 1500-kg vehicle travels at a constant speed of 22 m/s around a circular track that has a radius of 85 m. Which statement is true concerning the motion of this vehicle?

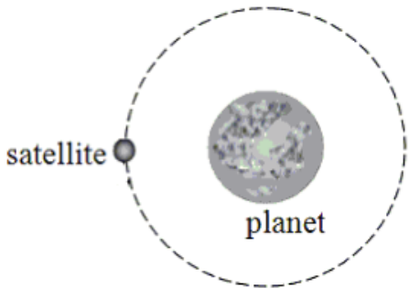
    (a) The velocity of the vehicle is changing.
    (b) The motion of the vehicle is characterized by constant velocity.
    (c) The motion of the vehicle is characterized by constant acceleration.
    (d) The vehicle has a velocity vector that points along the radius of the circle.
    (e) The vehicle has an acceleration vector that is tangent to the circle at all times.

18. A block is suspended by a rope from the ceiling of a car. When the car rounds a 45-m radius horizontal curve at 22 m/s, what angle does the rope make with the vertical?

    (a) 0 (b) 25° (c) 48° (d) 65° (e) 90°

Ref. questions 19 and 20: A 2700-kg satellite is in a circular orbit around a planet. The satellite completes one orbit in 7690 s.

The radius of the circular orbit is 9.27×10^6 m.



19. At the instant shown in the figure, which arrow indicates the direction of the net force on the satellite?

(a) → (b) ← (c) ↑ (d) ↓ (e) ↘

20. Determine the magnitude of the gravitational force exerted on the satellite by the planet.

(a) 1.2×10^4 N
(b) 1.7×10^4 N
(c) 5.0×10^{-3} N
(d) 7.5×10^{-4} N
(e) This cannot be determined since the mass and radius of the planet are not specified.

PHYS 1020 Midterm test, 18 October, 2012

Answer Key

Paper A

1	(d)
2	(e)
3	(d)
4	(e)
5	(d)
6	(e)
7	(d)
8	(d)
9	(b)
10	(b)
11	(c)
12	(e)
13	(c)
14	(d)
15	(a)
16	(b)
17	(a)
18	(c)
19	(a)
20	(b)