UNIVERSITY OF MANITOBA

October 23, 2014
(7:00 pm – 9:00 pm)

MID-TERM TEST
(+ Formula Sheet)

PAPER NO.: **A**

DEPARTMENT & COURSE NO.: PHYS 1020

TIME: 2 hours

EXAMINATION: General Physics 1

EXAMINERS: W. Ens,
K. Shamseddine, P. Zetner

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 one 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 should have limited memory capacity and should not be capable of remote communication. No phones or handheld computers (PDAs) or notes are permitted.

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.

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. A vector **F1** has a magnitude of 40.0 units and points 35.0° above the positive x axis. A second vector **F2** has a magnitude of 65.0 units and points in the positive y direction. Use the component method of vector addition to find the magnitude and direction relative to the positive x axis of the resultant **F** = **F1** + **F2**.

   (a) 53.3 units, 52.1° below the +x axis
   (b) 53.3 units, 52.1° above the +x axis
   (c) 93.8 units, 69.6° below the +x axis
   (d) 93.8 units, 69.6° above the +x axis
   (e) 76.3 units, 37.9° below the +x axis

2. During the first 18 minutes of a 1.0-hour trip, a car has an average speed of 11 m/s. What must the average speed of the car be during the last 42 minutes of the trip be if the car is to have an average speed of 21 m/s for the entire trip?

   (a) 21 m/s (b) 23 m/s (c) 25 m/s (d) 27 m/s (e) 29 m/s

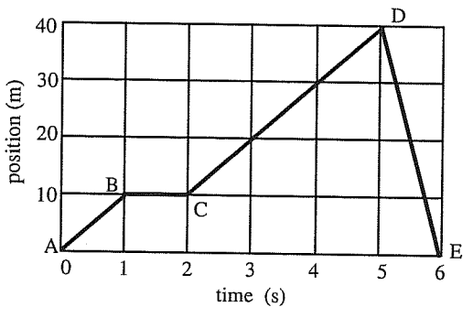
3. A race car has a speed of 80 m/s when the driver releases a drag parachute. If the parachute causes a deceleration of 4 m/s^2, how far will the car travel before it stops?

   (a) 20 m (b) 200 m (c) 400 m (d) 800 m (e) 1000 m

4. Ryan throws a tennis ball vertically upward. The ball returns to the point of release after 3.5 s. What is the speed of the ball as it is released?

(a) 0 m/s (b) 14 m/s (c) 17 m/s (d) 21 m/s (e) 34 m/s

5. An object is moving along a straight line. The graph shows the object's position from the starting point as a function of time.



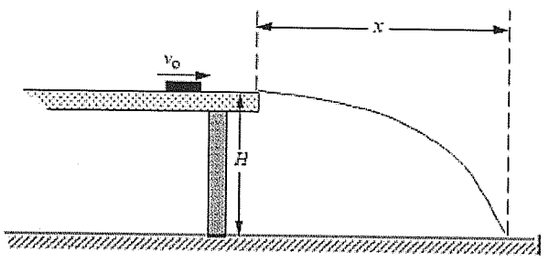
In which segment(s) of the graph does the object's *average velocity* (measured from $t = 0$ s) *decrease* with time?

(a) AB only
(b) BC only
(c) DE only
(d) AB and CD
(e) BC and DE

6. A quarterback throws a pass at an angle of 35° above the horizontal with an initial speed of 25 m/s. The ball is caught by the receiver 2.55 seconds later. Determine the distance the ball was thrown.

(a) 13 m (b) 18 m (c) 36 m (d) 52 m (e) 72 m

7. A puck slides across a smooth, level tabletop at height H at a constant speed v_0. It slides off the edge of the table and hits the floor a distance x away as shown in the figure.



What is the relationship between the distances x and H?

(a) $x = v_0\sqrt{\frac{2H}{g}}$ (b) $x = \frac{v_0^2}{2gH}$ (c) $x = \frac{v_0^2}{gH}$ (d) $H = v_0\sqrt{\frac{2x}{g}}$ (e) $x = v_0\frac{H}{g}$

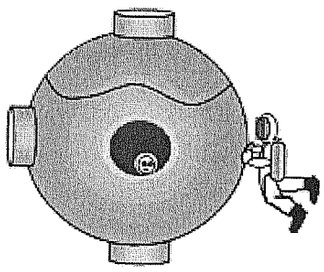
8. A motorcycle has a velocity of 24 m/s, due south as it passes a car with a velocity of 15 m/s, due north. What is the magnitude and direction of the velocity of the motorcycle as seen by the driver of the car?

(a) 9 m/s, north
(b) 9 m/s, south
(c) 15 m/s, north
(d) 39 m/s, north
(e) 39 m/s, south

9. A basketball player is running at a constant speed of 2.5 m/s when he tosses a basketball upward with a speed of 6.0 m/s. How far does the player run before he catches the ball? Ignore air resistance.

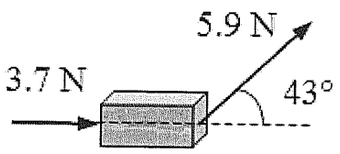
(a) 3.1 m
(b) 4.5 m
(c) The ball cannot be caught because it will fall behind the player.
(d) 6.0 m
(e) 7.5 m

10. A 70.0-kg astronaut pushes to the left on a spacecraft with a force $\vec{F}$ in "gravity-free" space. The spacecraft has a total mass of 1.0×10^4 kg. During the push, the astronaut accelerates to the right with an acceleration of 0.36 m/s^2. Determine the magnitude of the acceleration of the spacecraft.



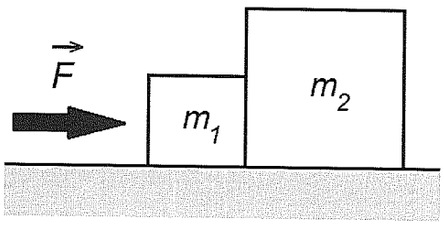
(a) 51.4 m/s^2
(b) 0.36 m/s^2
(c) 7.0×10^{-3} m/s^2
(d) 2.5×10^{-3} m/s^2
(e) 3.97×10^{-4} m/s^2

11. Two forces act on a 4.5-kg block sliding along a surface with a kinetic friction coefficient of 0.100. What is the magnitude of the horizontal acceleration of the block?



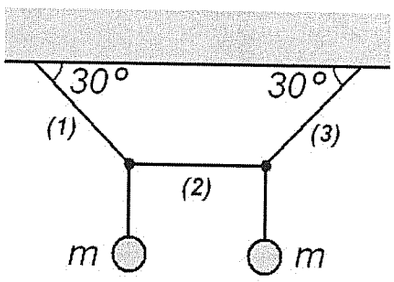
(a) 0.80 m/s^2 (b) 0.89 m/s^2 (c) 1.05 m/s^2 (d) 0.74 m/s^2 (e) 0.98 m/s^2

12. Two blocks are in contact on a horizontal frictionless surface as shown. A horizontal force **F** is applied to m_1 ($m_1 = 2.0$ kg, $m_2 = 5.0$ kg). What is the magnitude of **F** if the force exerted by m_1 on m_2 is 4.7 N?



(a) 9.4 N (b) 7.1 N (c) 4.7 N (d) 6.6 N (e) 12N

13. Two objects, each of mass *m* are suspended by three strings labelled (1), (2) and (3) in the figure. If the tension in string (2) is 20 N, what is the value of the mass?



(a) 3.5 kg
(b) 1.0 kg
(c) 1.2 kg
(d) 2.4 kg
(e) n.o.t

14. Two point masses *m* and *M* are separated by a distance *d*. If the distance between the masses is increased to 3*d*, how does the gravitational force between them change?

(a) It is impossible to determine without knowing the numerical values of *m*, *M*, and *d*.
(b) The force will be one-third as great.
(c) The force will be one-ninth as great.
(d) The force will be three times as great.
(e) The force will be nine times as great.

15. A 0.25-kg ball attached to a string is rotating in a horizontal circle of radius 0.5 m. If the ball revolves twice every second, what is the tension in the string?

(a) 2 N (b) 5 N (c) 7 N (d) 10 N (e) 20 N

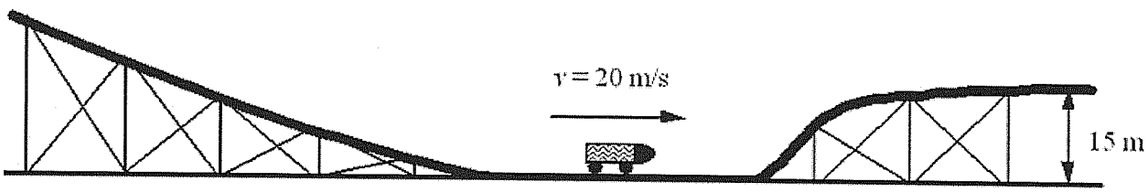
16. Determine the optimum angle at which a roadbed should be banked so that a car traveling at 20.0 m/s can safely negotiate the curve if the radius of the curve is 2.00×10^2 m.

(a) 0.200° (b) 0.581° (c) 11.5° (d) 19.6° (e) 78.2°

17. A 10.0-g bullet traveling horizontally at 755 m/s strikes a stationary target and stops after penetrating 14.5 cm into the target. What is the average force of the target on the bullet?

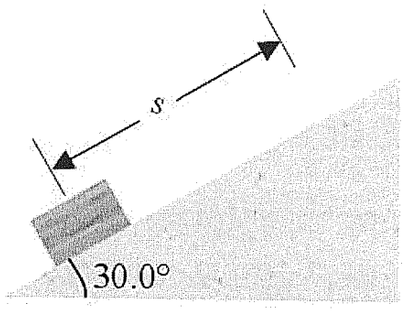
(a) 1.97×10^4 N (b) 2.07×10^5 N (c) 6.26×10^3 N
(d) 3.13×10^4 N (e) 3.93×10^4 N

18. A roller-coaster car is moving at 20 m/s along a straight horizontal track. What will its speed be after climbing the 15-m hill shown in the figure, if friction is ignored?



(a) 17 m/s (b) 7 m/s (c) 5 m/s (d) 10 m/s (e) 14 m/s

19. A physics student shoves a 0.50-kg block from the bottom of a frictionless 30.0° inclined plane. The student performs 4.0 J of work and the block slides a distance s along the incline before it stops. Determine the value of s.



(a) 8.0 cm
(b) 16 cm
(c) 82 cm
(d) 160 cm
(e) 330 cm

20. A dam is used to block the passage of a river and to generate electricity. Approximately 5.73×10^4 kg of water falls each second through a height of 19.6 m. If 85 % of the gravitational potential energy of the water were converted to electrical energy, how much power would be generated?

(a) 9.36×10^6 W
(b) 1.52×10^7 W
(c) 1.08×10^7 W
(d) 1.35×10^8 W
(e) 4.68×10^6 W

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ANSWER KEY

Paper A	Paper B
1. D	41. B
2. C	42. C
3. D	43. B
4. C	44. C
5. E	45. B
6. D	46. E
7. A	47. C
8. E	48. A
9. A	49. C
10. D	50. A
11. B	51. A
12. D	52. C
13. C	53. B
14. C	54. D
15. E	55. D
16. C	56. E
17. A	57. E
18. D	58. C
19. D	59. B
20. A	60. E