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 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 the first column of the accompanying IBM sheet in pencil. Also write "**Paper A**" next to your name on the IBM sheet.

TABLE OF CONSTANTS

$G = 6.673\times10^{-11}$ m^{3}kg^{-1}s^{-2} Mass of the earth = 5.98×10^{24} kg

$g = 9.8$ m/s^2 1 tonne = 10^3 kg

Radius of the earth = 6.38×10^3 km

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1. Using the dimensions given for the variables in the table, determine which one of the following expressions is correct.

variable	dimension
v	$\frac{[\mathrm{L}]}{[\mathrm{T}]}$
ρ	$\frac{[\mathrm{M}]}{[\mathrm{L}]^3}$
χ	$\frac{[\mathrm{L}][\mathrm{T}]^2}{[\mathrm{M}]}$

(a) $v = \frac{\chi}{\rho}$ (b) $v = \sqrt{\rho\chi}$ (c) $v = \rho\chi$ (d) $v = \frac{1}{\sqrt{\rho\chi}}$ (e) $v = \sqrt{\frac{\rho}{\chi}}$

2. A runaway dog walks 0.64 km due north. He then runs due west to a hot dog stand. If the magnitude of the dog's total displacement vector is 0.91 km, what is the magnitude of the component of the dog's displacement vector in the due west direction?

(a) 0.27 km (b) 0.33 km (c) 0.41 km (d) 0.52 km (e) 0.65 km

3. When the outdoor emergency warning siren at Cheryl's school was tested, the sound from the siren took 7.0 s to reach her house located 2.40 km from the school. What is the speed of sound in air?

(a) 240 m/s (b) 340 m/s (c) 440 m/s (d) 540 m/s (e) 640 m/s

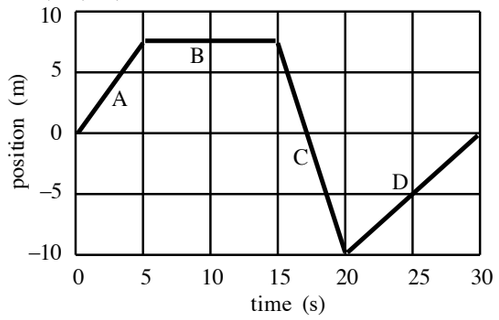
4. Two objects A and B accelerate from rest with the same constant acceleration. Object A accelerates for twice as much time as object B, however. Which one of the following statements is true concerning these objects at the end of their respective periods of acceleration?

(a) Object A will travel twice as far as object B.
(b) Object A will travel four times as far as object B.
(c) Object A will travel eight times further than object B
(d) Object A will be moving four times faster than object B.
(e) Object A will be moving eight times faster than object B.

5. Water drips from rest from a leaf that is 15 meters above the ground. Neglecting air resistance, what is the speed of each water drop when it hits the ground?

(a) 30 m/s (b) 17 m/s (c) 40 m/s (d) 15 m/s (e) 20 m/s

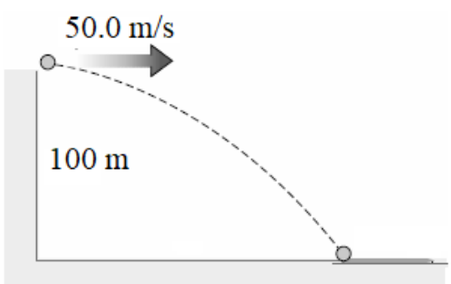
6. An object is moving along a straight line in the positive *x* direction. The graph shows its position from the starting point as a function of time. Various segments of the graph are identified by the letters A, B, C, and D.



Which segment(s) of the graph represent(s) a *constant velocity* of +1.0 m/s?

(a) A (b) B (c) C (d) D (e) A and D

7. As shown in the figure, a projectile is fired horizontally with a speed of 50.0 m/s from the top of a tower 100 m high. With what velocity will it strike the level ground?

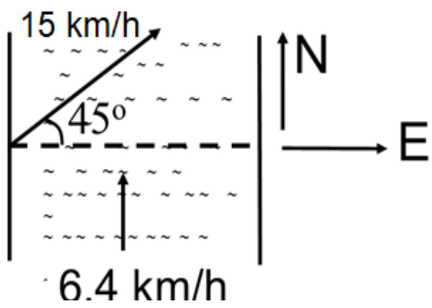


(a) 44.3 m/s; 41.5° below the horizontal (b) 50.0 m/s; 30.0° below the horizontal
(c) 66.8 m/s; 41.5° below the horizontal (d) 74.3 m/s; 41.5° above the horizontal
(e) 44.6 m/s; 45.5° below the horizontal

8. A cannon is aimed 38.6° above the horizon. When a shell is fired, the speed on leaving the muzzle is 400 m/s. How far away does the shell hit the ground (ignore air resistance and the height of the muzzle)?

(a) 25.2 km (b) 15.9 km (c) 31.2 km (d) 18.9 km (e) 29.3 km

9. A boat can sail at 15 km/h in still water. If it sails 45° north of east with respect to a river flowing 6.4 km/h north, as observed from the shore, the boat's direction is:

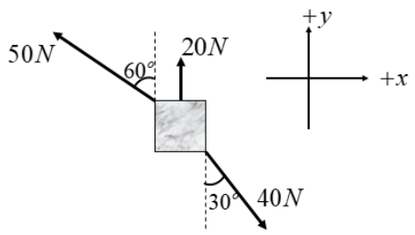


(a) 30°, East of north (b) 58°, North of east (c) 65°, North of east
(d) 75°, East of north (e) 68°, East of north

10. A rock is thrown straight up from the earth's surface. Which one of the following statements concerning the *net force* acting on the rock at the top of its path is true?

(a) The net force is equal to the weight of the rock.
(b) The net force is instantaneously equal to zero newtons.
(c) The direction of the net force changes from up to down.
(d) The net force is greater than the weight of the rock.
(e) The net force is less than the weight of the rock, but greater than zero newtons.

11. A block is acted upon by three forces as shown in the figure. If the acceleration of the block in the $+y$ direction is 3.0 m/s^2, what is the mass of the block?



(a) 2.3 kg (b) 1.8 kg (c) 5.5 kg (d) 4.5 kg (e) 3.5 kg

12. A boy pulls a 5.0-kg sled with a rope that makes a 60.0° angle with respect to the horizontal surface of a frozen pond. The boy pulls on the rope with a force of 10.0 N; and the sled moves with constant velocity. What is the coefficient of friction between the sled and the ice?

(a) 0.09 (b) 0.12 (c) 0.18 (d) 0.06 (e) 0.24

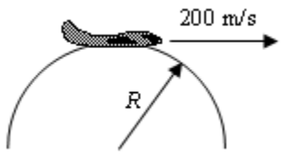
13. A planet has a mass approximately 318 times as large as the mass of the earth, and its mean radius is approximately 11 times as large as the mean radius of the earth. What is the acceleration due to gravity on the surface of the planet?

(a) 22 m/s^2 (b) 16 m/s^2 (c) 26 m/s^2 (d) 18 m/s^2 (e) 29 m/s^2

14. A car enters a horizontal, curved roadbed of radius 50 m. The coefficient of static friction between the tires and the roadbed is 0.20. What is the maximum speed with which the car can safely negotiate the unbanked curve?

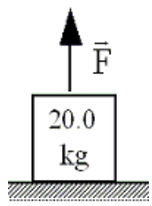
(a) 5 m/s (b) 10 m/s (c) 20 m/s (d) 40 m/s (e) 100 m/s

15. A plane is traveling at 200 m/s following the arc of a vertical circle of radius *R*. At the top of its path, the passengers experience weightlessness. To one significant figure, what is the value of *R*?



(a) 200 m (b) 1000 m (c) 2000 m (d) 4000 m (e) 40 000 m

16. A rope exerts a force **F** on a 20.0-kg crate. The crate starts from rest and accelerates upward at 5.00 m/s^2 near the surface of the earth. What is the kinetic energy of the crate when it is 4.0 m above the floor?



(a) 400 J (b) 250 J (c) 116 J (d) 704 J (e) 1180 J

17. Julie carries an 8.0-kg suitcase as she walks 18 m along a horizontal walkway to her hotel room at a constant speed of 1.5 m/s. How much work does Julie do in carrying her suitcase?

(a) zero joules (b) 40 J (c) 200 J (d) 300 J (e) 2000 J

18. 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

19. Two balls of equal size are dropped from the same height from the roof of a building. One ball has twice the mass of the other. When the balls reach the ground, how do the kinetic energies of the two balls compare? Ignore air resistance.

(a) The lighter one has one fourth as much kinetic energy as the other does.
(b) The lighter one has one half as much kinetic energy as the other does.
(c) The lighter one has the same kinetic energy as the other does.
(d) The lighter one has twice as much kinetic energy as the other does.
(e) The lighter one has four times as much kinetic energy as the other does.

20. The amount of energy needed to power a 0.10-kW bulb for one minute would be just sufficient to lift a 1.0-kg object through a vertical distance of

(a) 12 m (b) 75 m (c) 100 m (d) 120 m (e) 610 m

The End

PHYS 1020 Oct Midterm 2017 Answer Key Paper A

1. D
2. E
3. B
4. B
5. B
6. D
7. C
8. B
9. B
10. A
11. E
12. B
13. C
14. B
15. D
16. A
17. A
18. A
19. B
20. E