UNIVERSITY OF MANITOBA

October 24, 2013 MID-TERM TEST
(7:00 pm – 9:00 pm) (+ Formula Sheet)

PAPER NO.: **A** PAGE NO.: 1 of 5

DEPARTMENT & COURSE NO.: PHYS 1020 TIME: 2 hours

EXAMINATION: General Physics 1 EXAMINERS: R. Cameron, W. Ens
A. Shalchi, K. Shamseddine

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 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

$G = 6.673\times10^{-11}$ 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
f	$\frac{1}{[\mathrm{T}]}$
l	[L]
g	$\frac{[\mathrm{L}]}{[\mathrm{T}]^2}$

A) $f = \frac{g}{2\pi l}$ B) $f = 2\pi gl$ C) $2\pi f = \sqrt{\frac{g}{l}}$ D) $2\pi f = \sqrt{\frac{l}{g}}$ E) $f = 2\pi\sqrt{gl}$

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2. Two vectors $\vec{A}$ and $\vec{B}$ are added together to form a vector $\vec{C}$. The relationship between the magnitudes of the vectors is given by $A + B = C$. Which one of the following statements concerning these vectors is true?

   A) $\vec{A}$ and $\vec{B}$ must be displacements.
   B) $\vec{A}$ and $\vec{B}$ must have equal lengths.
   C) $\vec{A}$ and $\vec{B}$ must point in opposite directions.
   D) $\vec{A}$ and $\vec{B}$ must point in the same direction.
   E) $\vec{A}$ and $\vec{B}$ must be at right angles to each other.

3. At 10:00 a.m. a dog sleeps in his dog house. At 10:01 a.m. the dog wakes and begins walking due east at a speed of 0.5 m/s. At 10:03 the dog sees a mailman and runs, due east, at 1.2 m/s. At 10:04 a.m. the dog reaches a fence and sits down. What is the magnitude of the average acceleration of the dog during this four minute time interval?

   A) 0.18 m/s^2 B) 0.55 m/s^2 C) 2.9×10^{-3} m/s D) 0.73 m/s^2 E) zero

4. In which one of the following situations does the car have a westward acceleration?

   A) The car travels westward at constant speed.
   B) The car travels eastward and speeds up.
   C) The car travels westward and slows down.
   D) The car travels eastward and slows down.
   E) The car starts from rest and moves toward the east.

5. A car travels in a straight line covering a total distance of 90.0 km in 60.0 minutes. Which one of the following statements concerning this situation is *necessarily* true?

   A) The velocity of the car is constant.
   B) The acceleration of the car must be non-zero.
   C) The first 45 km must have been covered in 30.0 minutes.
   D) The speed of the car must be 90.0 km per hour throughout the entire trip.
   E) The average velocity of the car is 90.0 km per hour in the direction of motion.

6. A rock is dropped from rest from a height h above the ground. It falls and hits the ground with a speed of 11 m/s. From what height should the rock be dropped so that its speed on hitting the ground is 22 m/s? Neglect air resistance.

   A) 1.4h B) 2.0h C) 3.0h D) 4.0h E) 0.71h

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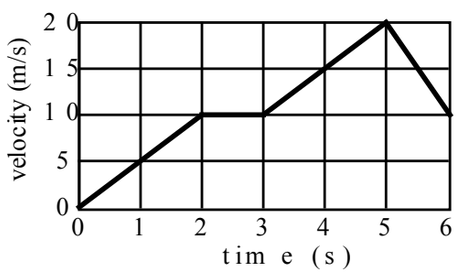
7. An object is moving along a straight line. The graph shows the object's velocity as a function of time.



How far does the object move in the interval from $t = 0$ to $t = 2$ s?

A) 7.5 m B) 10 m C) 15 m D) 20 m E) 25 m

8. A park ranger wanted to measure the height of a tall tree. The ranger stood 9.50 m from the base of the tree; and he observed that his line of sight made an angle of 65.2° above the horizontal as he looked at the top of the tree. The park ranger's eyes are 1.80 m above the ground. What is the height of the tree?

A) 5.84 m B) 8.77 m C) 11.7 m D) 17.3 m E) 22.4 m

9. A physics student standing on the edge of a cliff throws a stone vertically *downward* with an initial speed of 10.0 m/s. The instant before the stone hits the ground below, it is traveling at a speed of 30.0 m/s. If the physics student were to throw the rock *horizontally outward* from the cliff instead, with the same initial speed of 10.0 m/s, what is the magnitude of the velocity of the stone just before it hits the ground?

A) 10.0 m/s B) 20.0 m/s C) 30.0 m/s D) 40.0 m/s
E) The height of the cliff must be specified to answer this question.

10. A boat that can travel at 4.0 km/h in still water crosses a river with a current of 2.0 km/h. At what angle must the boat be pointed upstream (that is, relative to its actual path) to go straight across the river?

A) 27° B) 30° C) 60° D) 63° E) 90°

11. A ball is fired at an angle of 45°, the angle that yields the maximum range in the absence of air resistance. What is the ratio of the ball's maximum height to its range?

A) 1.0 B) 0.75 C) 0.67 D) 0.50 E) 0.25

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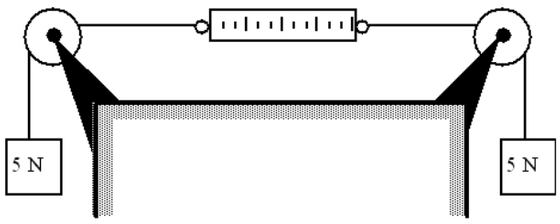
12. A basketball player is running at a constant speed of 2.5 m/s when he tosses a basketball upward with a speed of 6.0 m/s. How far does the player run before he catches the ball? Ignore air resistance.

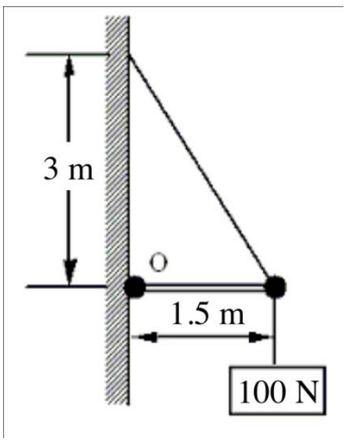
A) 3.1 m
B) 4.5 m
C) The ball cannot be caught because it will fall behind the player.
D) 6.0 m
E) 7.5 m

13. Two 5-N boxes are attached to opposite ends of a spring scale and suspended from pulleys as shown.
What is the reading on the scale?



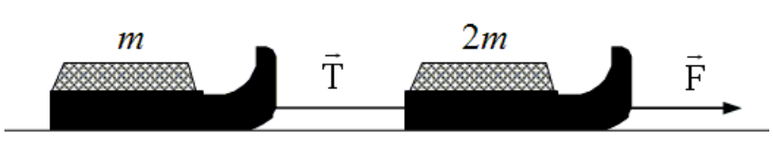
A) 0 N
B) 2.5 N
C) 5 N
D) 10 N
E) 25 N

14. A *massless horizontal strut* is attached to the wall at the hinge O. Which one of the following phrases best describes the force that the hinge pin applies *to the strut* if the weight of the cables is also neglected?



A) 50 N, to the right
B) 100 N, straight up
C) 200 N, to the right
D) 244 N, 27º above the strut
E) 56 N, to the left

15. Two sleds are hooked together in tandem as shown in the figure. The front sled is twice as massive as the rear sled.
The sleds are pulled along a frictionless surface by an applied force $\vec{\mathbf{F}}$. The tension in the rope between the sleds is $\vec{\mathbf{T}}$.
Determine the ratio of the magnitudes of the two forces, $\frac{T}{F}$.



A) 0.25 B) 0.33 C) 0.50 D) 0.67 E) 2.0

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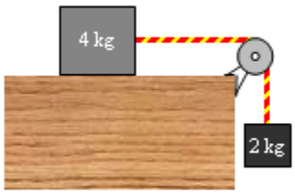
16. A 4-kg block is connected by means of a *massless* rope to a 2-kg block as shown in the figure. Complete the following statement: If the 4-kg block is to begin sliding, the coefficient of static friction between the 4-kg block and the surface must be



A) less than zero.
B) greater than 2.
C) greater than 1, but less than 2.
D) greater than 0.5, but less than 1.
E) less than 0.5, but greater than zero.

17. A 20.0-kg package is dropped from a high tower in still air and is "tracked" by a radar system. When the package is 25 m above the ground, the radar tracking indicates that its acceleration is 7.0 m/s^2. Determine the magnitude of the force of air resistance on the package.

A) 56 N B) 28 N C) 280 N D) 196 N E) 140 N

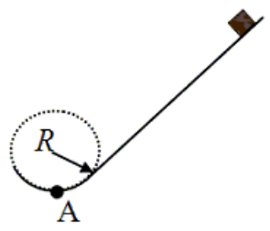
18. An object weighs 10 N on the earth's surface. What is the weight of the object on a planet that has one tenth the earth's mass and one half the earth's radius?

A) 4 N B) 2 N C) 1 N D) 10 N E) 20 N

19. A space station is designed in the shape of a large, hollow donut that is uniformly rotating. The outer radius of the station is 350 m. With what period must the station rotate so that a person sitting on the outer wall experiences "artificial gravity," i.e. an acceleration of 9.8 m/s^2?

A) 230 s B) 170 s C) 110 s D) 76 s E) 38 s

20. A 25-kg box is sliding down an ice-covered hill. When it reaches point A, the box is moving at 11 m/s. Point A is at the bottom of a circular arc that has a radius R = 7.5 m. What is the magnitude of the normal force on the box at Point A?



A) 250 N B) 280 N C) 400 N D) 650 N E) 900 N

PHYS 1020 Midterm Exam, October 24, 2013

Version A answer key

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