

Name \_\_\_\_\_  
Student Number \_\_\_\_\_

## PHYSICS 1A03

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DAY CLASS & NIGHT CLASS

DURATION OF MID-TERM EXAMINATION: 2 Hours

MCMASTER UNIVERSITY, October 9, 2015

THIS EXAMINATION PAPER INCLUDES 26 MULTIPLE CHOICE QUESTIONS. YOU ARE RESPONSIBLE FOR ENSURING THAT YOUR COPY OF THE PAPER IS COMPLETE. BRING ANY DISCREPANCY TO THE ATTENTION OF YOUR INVIGILATOR.

No books, notes, or other aids are permitted.

- You must be prepared to show your student card to the exam invigilators
- Circle the correct answer on this exam paper **AND** on the computer-readable scan sheet.
- There is only one correct answer for each question, no penalty for guessing a wrong answer.
- Return this paper with your answer sheet.
- A formula sheet is included with this exam paper (Last Page) as well as extra pages for scrap. These may be removed but must be handed in with your exam.
- By writing this examination you agree to be bound by the Senate policy of Academic Dishonesty
- All portable communication devices must be off during tests
- Only the McMaster standard calculator is allowed.
- There are a total of 26 multiple choice questions. Each question is worth 1 mark except question 1. Question 1 is only used to identify your exam version, and is not worth any marks.

**COMPUTER SCAN SHEET STUDENT INSTRUCTIONS: IT IS YOUR RESPONSIBILITY TO ENSURE THAT THE ANSWER SHEET IS PROPERLY COMPLETED. YOUR EXAMINATION RESULT DEPENDS UPON PROPER ATTENTION TO THESE INSTRUCTIONS.**

The scanner, which reads the sheets, senses the bubble shaded areas by their non-reflection of light. A heavy mark must be made, completely filling the circular bubble, with an **HB pencil**. Marks made with a pen or felt-tip marker will **NOT** be sensed. Erasures must be thorough or the scanner may still sense a mark. Do **NOT** use correction fluid on the sheets. Do **NOT** put any unnecessary marks or writing on the answer sheet.

1. Print your name, student number, course name, section number, instructor name, and the date in the spaces provided at the top of Side 1 (red side) of the sheet. Then you **MUST** sign the sheet in the space marked SIGNATURE.

2. Mark your student number in the space provided and fill in the corresponding bubble numbers underneath.

3. Mark only **ONE** choice from the alternatives (a, b, c, d, e) provided for each question. The question number is to the left of the bubbles. Make sure that the number of the question on the scan sheet is the same as the question number on the test paper.

4. Pay particular attention to the Marking Directions on the form

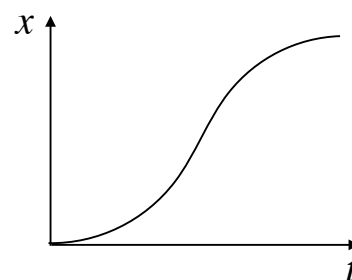
continued on next page

- Q1. **This is version B of the test. Choose B as the correct answer to this question.** Answering this question incorrectly will adversely affect the marking of your test.
- Q2. Using scientific notation and the correct number of significant figures, what is the result of calculation
- $$(3.2323 - 1.089205) \times \frac{3.48}{1.289}$$
- A. 5.8  
B. 5.78  
C. 5.79  
D. 5.785  
E. 5.786
- Q3. Suppose  $A = BC$ , where A has dimension  $[M/L]$  and C has dimension  $[L/T^2]$ . Then B has the dimension:
- A.  $[MT^2/L^2]$   
B.  $[M/T^2]$   
C.  $[L^2/MT^2]$   
D.  $[M/L]$   
E. none of the above
- Q4. For the following,  $123.206 - 2.89 + 68.5$ , how many significant figures are there in the answer?
- A. 2  
B. 3  
C. 4  
D. 5  
E. 6
- Q5. Approximately how many liters of water are needed to fill your bathtub?
- A.  $10^0$  l  
B.  $10^2$  l  
C.  $10^4$  l  
D.  $10^6$  l  
E.  $10^8$  l
- Q6. You are about to eat a delicious hamburger, but beforehand you measure the size of the burger and find that it has a volume of  $40 \text{ cm}^3$ , and has a mass of 300 g. The density of your hamburger, in  $\text{kg/m}^3$ , is:
- A.  $1.3 \times 10^{-1}$   
B.  $1.3 \times 10^{-4}$   
C. 7.5  
D.  $7.5 \times 10^{-1}$   
E.  $7.5 \times 10^3$
- Q7. How many times does a heart beat in a typical lifetime?
- A.  $10^5$   
B.  $10^7$   
C.  $10^9$   
D.  $10^{13}$   
E. none of the above are a reasonable estimate

- Q8. A motorist drives north for 35.9 min at 73.3 km/hr and then stops for 15.4 min. He then continues north, traveling 114.5km in 1.93hr. What is his average velocity?
- A. 62.7 km/h [north]
  - B. 53.9 km/h [north]
  - C. 56.9 km/h [north]
  - D. 47.3 km/h [north]
  - E. none of the above
- Q9. A ball thrown horizontally at 26.9 m/s travels a horizontal distance of 45.9 m before hitting the ground. From what height was the ball thrown?
- A. 8.38 m
  - B. 14.3 m
  - C. 1.68 m
  - D. 2.87 m
  - E. 9.82 m
- Q10. A rock is tossed straight up with a velocity of 38.0m/s. When it returns, it falls into a hole 23.4m deep. How long is the rock in the air, from the instant it is released until it hits the bottom of the hole?
- A. 8.32 s
  - B. 7.08 s
  - C. 6.13 s
  - D. 9.77 s
  - E. 0.57 s
- Q11. A guy riding a buffalo is chasing you at a top speed of 50 km/h, you are well ahead of the rider by 2 km, but your speed is only 20 km/h. How much time do you have to come up with a better plan?
- A. 2 min
  - B. 4 min
  - C. 0.067 min
  - D. 1.71 min
  - E. 2.4 min
- Q12. A small nematode crawls along at a speed of  $10^{-2}$  inches per minute. What is that in micro-meters per second? [39.4 inches = 1 m][micro ( $\mu$ ) means  $10^{-6}$ ]
- A.  $2.6 \times 10^7 \mu\text{m/s}$
  - B.  $1.5 \times 10^4 \mu\text{m/s}$
  - C.  $4.2 \times 10^{-12} \mu\text{m/s}$
  - D.  $4.2 \mu\text{m/s}$
  - E.  $6.6 \times 10^3 \mu\text{m/s}$

Q13. The following graph represents the motion of an object whose velocity is:

- A. decreasing
- B. first decreasing then increasing
- C. increasing
- D. first increasing then decreasing
- E. more information needed.

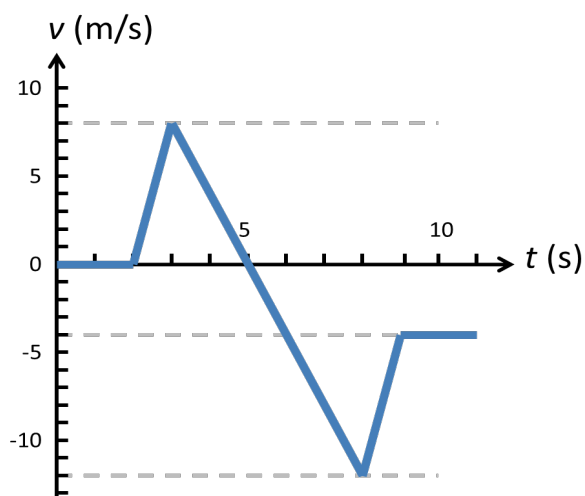


Q14. If a car traveling at 28 m/s brought to a full in stop in 4.0 s after the brakes are applied, The car average acceleration is:

- A.  $+7 \text{ m/s}^2$ .
- B.  $+3.5 \text{ m/s}^2$ .
- C. 0
- D.  $3.5 \text{ m/s}^2$ .
- E.  $-7 \text{ m/s}^2$ .

Q15. The **velocity vs. time** graph for an object moving along the x-axis is shown. Which of the following statements is true?

- A. The average acceleration from  $t = 3.0 \text{ s}$  to  $t = 9.0 \text{ s}$  is  $-2.0 \text{ m/s}^2$ .
- B. The instantaneous acceleration at  $t = 5.0 \text{ s}$  is  $-4.0 \text{ m/s}^2$ .
- C. Both A and B are correct.
- D. Neither B nor A is correct.
- E. The acceleration is negative for  $t > 5.0 \text{ s}$



Q16. The volume of liquid flowing per second is called volume flow rate  $Q$

and has the dimensions of  $[L]^3/[T]$ . The flow rate of liquid through a hypodermic needle during an injection can be estimated with the equation

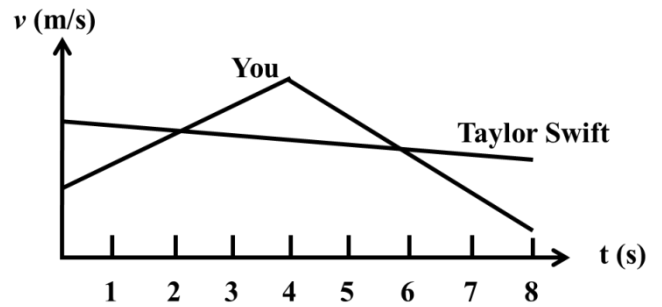
$$Q = \frac{\pi R^n (P_2 - P_1)}{8\eta L}$$

shown. The length and radius of the needle are  $L$  and  $R$ , respectively both of which have the dimension  $[L]$ . The pressures at opposite ends of the needle  $P_2$  and  $P_1$ , both which have

dimensions of  $[M]/([L][T]^2)$ .  $\eta$  is the viscosity of the liquid and has dimensions of  $[M]/([L][T])$ .  $\pi$ , 8 and the exponent  $n$ , has no dimensions. Using dimension analysis, what is the value of  $n$  in the expression for  $Q$

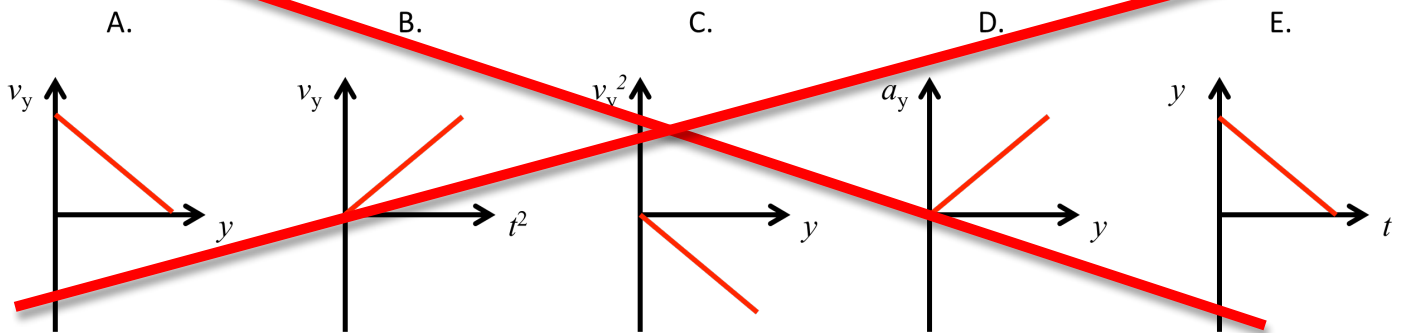
- A.  $1/2$
- B. 4
- C. 1
- D. 5
- E. Dimensional analysis does not work for exponents

Q17. You and Taylor Swift have a race to see who is the swiftest (fastest). Based on the velocity-time graph of your race, you can say that:



- A. Taylor passes to you at  $t = 2s$ , then you pass her at  $t = 6s$ .
- B. You pass Taylor at  $t = 2s$ , then she passes you at  $t = 6s$ .
- C. Taylor passes to you at  $t = 4s$ , then you catch up to her at  $t = 8s$ .
- D. You pass Taylor at  $t = 4s$ , then she catches up to you at  $t = 8s$**

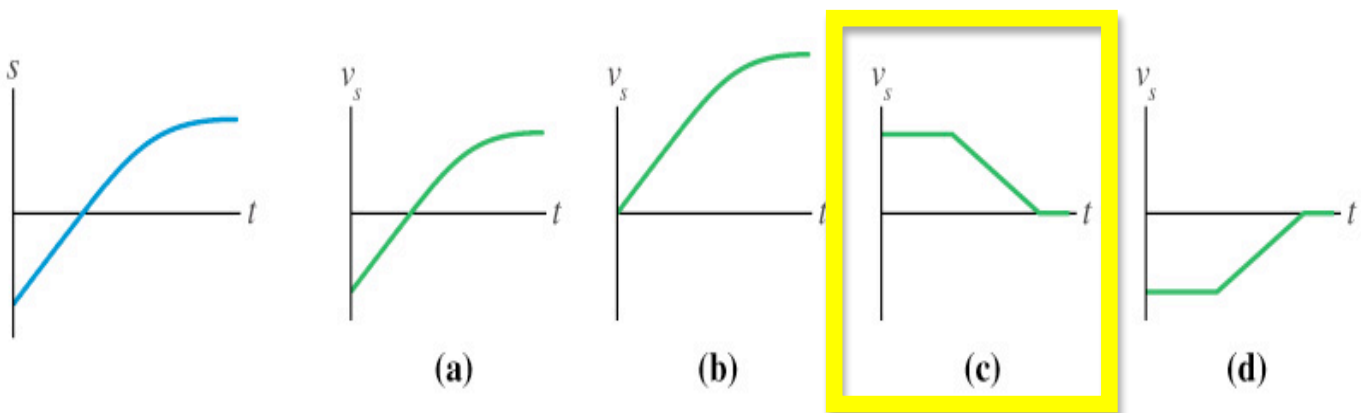
Q18. Take an object that is in free fall, we have a kinematic relationship which represents the quantities  $y$ ,  $v_y$ ,  $a_y$ ,  $t$ . Assuming up is the positive direction, which of the following plots correctly represents the kinematic equations (assume all other quantities are kept constant).



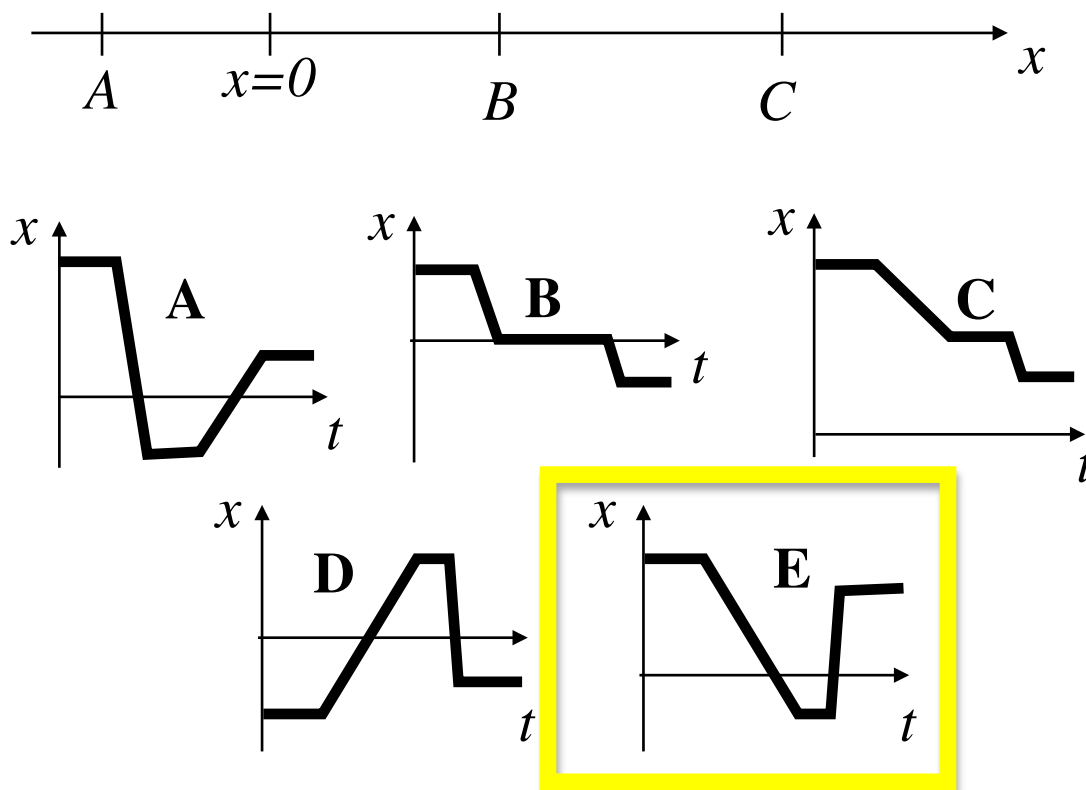
Q19. 1 m is equivalent to 3.28 ft. A cube with an edge of 2.5 ft has a volume of:

- A.  $4.8 \text{ m}^3$
- B.  $4.4 \times 10^{-1} \text{ m}^3$**
- C.  $48.6 \text{ m}^3$
- D.  $4.3 \times 10^{-2} \text{ m}^3$
- E.  $8.6 \times 10^2 \text{ m}^3$

Q20. Which velocity-versus-time graph goes with this position-versus-time graph on the left?



Q21. A person initially at point C on the x-axis stays there for a little while and then strolls along the x-axis to point A, stays there for a moment and then runs to point B and remains there. Which graph most closely depicts this motion?



Q22. For the formula given, which relationship, when plotted on a graph would yield a straight line?

$$\frac{Q}{4U} = 3t^3$$

- A. Plot of  $Q$  versus  $1/U$ , with  $t$  constant
- B. Plot of  $U$  versus  $1/Q$ , with  $t$  constant
- C. Plot of  $Q/U$  versus  $t$
- D. Plot of  $1/U$  versus  $t^3$ , with  $Q$  constant**
- E. Plot of  $t$  versus  $Q$ , with  $U$  constant

Q23. Einswine is catapulted vertically upward in (the positive direction). While he is rising:

- A. His velocity and acceleration are both upward.
- B. His velocity is upward and its acceleration is downward.**
- C. His velocity and acceleration are both downward.
- D. His velocity is downward and its acceleration is upward.
- E. His velocity and acceleration are both decreasing.

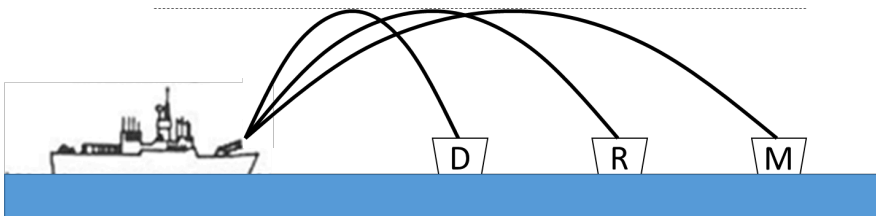
Q24. Two rocks are dropped from a cliff, one a few tenths of a second after the first. If air resistance is ignored, as they fall

- A. the vertical distance between them remains constant while they are both in the air.
- B. the vertical distance between them continually decreases while they are both in the air.
- C. the vertical distance between them continually increases while they are both in the air.
- D. the vertical distance between them first increases, then decreases while they are both in the air.

Q25. Two points in a rectangular coordinate system have the coordinates  $(4.75, 2.33)$  and  $(-3.64, 4.28)$ , where the units are centimeters. Determine the distance between these points:

- A. 8.2 cm
- B. 2.24 cm
- C. 10.68 cm
- D. 74.19 cm
- E. 8.61 cm

Q26. Three physics professors are launched simultaneously towards yogurt-cups. Which professor reaches their nutritious (and delicious!) treat first? [Neglect air resistance]



- A. D – Dalnoki-Veress
- B. R – Rheinstädter
- C. M – Massa
- D. They all reach their yogurt at the same time
- E. At least one of them misses, and we cancel the midterm

END OF MID TERM EXAM



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## Formula Sheet for Physics 1A03 Midterm Exam I

**Constants:**

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

**Area:**

$$A = \pi R^2, \quad A = 4\pi R^2, \quad A = 2\pi R h$$

**Volume:**

$$V = \frac{4}{3}\pi R^3, \quad V = \pi R^2 h$$

**Other:**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\sin \theta = \frac{\textit{opposite}}{\textit{hypotenuse}} \textit{ or } = \frac{\textit{rise}}{\textit{hypotenuse}}$$

$$\cos \theta = \frac{\textit{adjacent}}{\textit{hypotenuse}}$$

$$\tan \theta = \frac{\textit{opposite}}{\textit{adjacent}}$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

**Kinematics:**

$$v_f = v_i + at$$

$$\Delta x = v_i t + \frac{1}{2}at^2$$

$$v_f^2 - v_i^2 = 2a \Delta x$$

$$\Delta x = \frac{(v_i + v_f)}{2} t$$