

**IB Physics Semester 1 Final Exam Review:  
Physical Measurement, Mechanics, Nuclear Physics (pt. 1)**

There are 3 parts to your final exam review assignment: Key terms/vocab, equations, and practice problems from your textbook. Points will be awarded for completion of the questions, and some extra credit may be awarded. Make sure you use your syllabus statement book as you review to help you remember the things that we've studied (as well as reviewing the notes that are posted online! ☺)

**Part 1: Key Vocab—complete at least 50% of these**

On [www.physicsrocks.com](http://www.physicsrocks.com) you will find the unit pages for each of the three topics we've covered this semester. On the unit pages you will find lists of the key terms for each unit. Please rewrite the term/concept and then define or describe it in your own words.

**Part 2: Equations—(complete all equations)**

For each of the equations in the data booklet for topic 1 (3 of them) and topic 2 (11 of them), and topic 3 (2 of them), do the following in a typed word document:

- Re-write the equation, describe what each of the variables represents, and state when/how you would use that equation

**Part 3: Problems (complete at least the minimum stated for each chapter)**

Many (not all) of the topics on your syllabus statements involve some sort of calculation or conceptual practice that can be found in the chapter review questions in your textbook. (found at the end of each chapter!)

- For each of the chapters listed you must complete a minimum number of problems.
- If you do more than the minimum, you will earn some extra credit for your extra effort. (amount TBD...depends on how much you do!)
- You **MUST show all work** (variables listed, equation shown, plug in values, circle final answer) to earn credit for a problem little to no work, **NO CREDIT!**
- Your work must be neat, clear, legible, and organized—if I can't make sense of your work, I'll probably miss something and you'll get fewer points than you really should. Bummer—I'm going to grade/count your work **ONCE**.
- Complete at least half of the questions for each column for each chapter.

Chapter 1:

<b>Mult. Choice (p. 26)</b>	<b>Conceptual (p. 27)</b>	<b>Exercises (p. 28)</b>
2, 3, 6, 15, 16, 17	15, 17	5, 28, 33, 45, 47, 51

Chapter 2:

<b>Mult. Choice (p. 58)</b>	<b>Conceptual (p. 59)</b>	<b>Exercises (p. 60)</b>
1, 5, 6, 10, 13, 18, 19	1, 8, 12, 16	2, 7, 23, 30, 33, 38, 47, 50, 59, 63, 64, 71

Chapter 3:

<b>Mult. Choice (p. 94)</b>	<b>Conceptual (p. 95)</b>	<b>Exercises (p. 96)</b>
5, 6, 11, 12	15, 18	1, 4, 6, 10, 38, 68, 70

Chapter 4:

<b>Mult. Choice (p. 131)</b>	<b>Conceptual (p. 132)</b>	<b>Exercises (p. 134)</b>
3, 4, 6, 11	1, 7, 9	4, 5, 13, 16, 18a, 22, 32, 40, 42, 47

Chapter 5:

<b>Mult. Choice (p. 172)</b>	<b>Conceptual (p. 173)</b>	<b>Exercises (p. 174)</b>
2, 9, 10, 16,	11, 15,	3, 14, 30, 37, 45, 51, 53, 67

Chapter 6:

<b>Mult. Choice (p. 213)</b>	<b>Conceptual (p. 213)</b>	<b>Exercises (p. 215)</b>
1, 3, 7, 11, 12	4, 5, 7, 10, 15, 16	2, 5, 13, 16, 19, 26, 28, 37, 45, 47, 59, 60

Chapter 10:

<b>Mult. Choice (p. 380)</b>	<b>Conceptual (p. 380)</b>	<b>Exercises (p. 383)</b>
1, 2, 4, 7, 10, 11	10, 16	15, 16, 19, 53

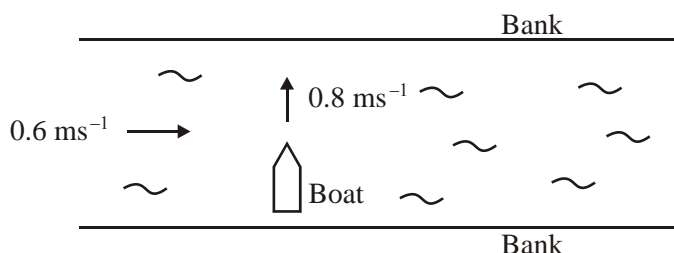
Chapter 11:

<b>Mult. Choice (p. 411)</b>	<b>Conceptual (p. 411)</b>	<b>Exercises (p. 412)</b>
4, 6, 8, 10, 12, 13	2, 5, 7, 10,	7, 8, 14, 18, 25, 26, 34, 35, 40, 41

**Part 4: Multiple Choice review/practice—strongly recommended, not required.**

Instructions: For each question, circle the correct answer. In the space near the question write a sentence or two explaining WHY that is the correct answer.

1. The diagram below shows a boat that is about to cross a river in a direction perpendicular to the bank at a speed of  $0.8 \text{ ms}^{-1}$ . The current flows at  $0.6 \text{ ms}^{-1}$  in the direction shown.



The magnitude of the displacement of the boat 5 seconds after leaving the bank is

- A. 3 m.  
 B. 4 m.  
 C. 5 m.  
 D. 7 m. (1)
2. The ratio  $\frac{\text{diameter of a nucleus}}{\text{diameter of an atom}}$  is approximately equal to
- A.  $10^{-15}$ .  
 B.  $10^{-8}$ .  
 C.  $10^{-5}$ .  
 D.  $10^{-2}$ . (1)
3. Which **one** of the following lists a fundamental unit and a derived unit?
- |    |         |          |
|----|---------|----------|
| A. | ampere  | second   |
| B. | coulomb | kilogram |
| C. | coulomb | newton   |
| D. | metre   | kilogram |
- (1)
4. The number of heartbeats of a person at rest in one hour, to the nearest order of magnitude is
- A.  $10^1$ .  
 B.  $10^2$ .  
 C.  $10^3$ .  
 D.  $10^5$ . (1)

5. The time period  $T$  of oscillation of a mass  $m$  suspended from a vertical spring is given by the expression

$$T = 2\pi \sqrt{\frac{m}{k}}$$

where  $k$  is a constant.

Which **one** of the following plots will give rise to a straight-line graph?

- A.  $T^2$  against  $m$
- B.  $\sqrt{T}$  against  $\sqrt{m}$
- C.  $T$  against  $m$
- D.  $\sqrt{T}$  against  $m$

(1)

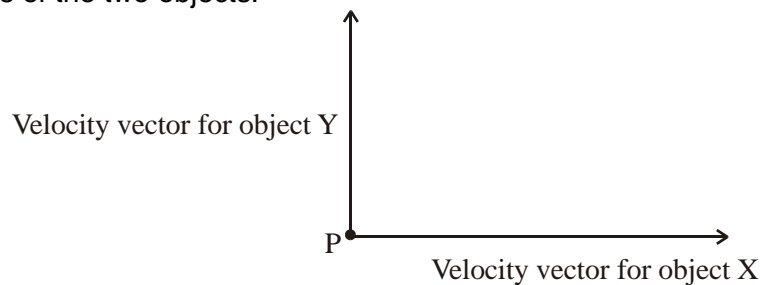
6. Which of the following is the best estimate, to one significant digit, of the quantity shown below?

$$\frac{\pi \times 8.1}{\sqrt{(15.9)}}$$

- A. 1.5
- B. 2.0
- C. 5.8
- D. 6.0

(1)

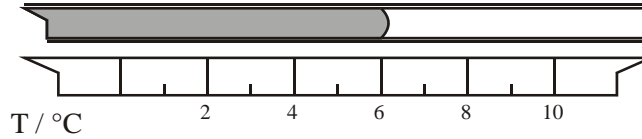
7. Two objects X and Y are moving away from the point P. The diagram below shows the velocity vectors of the two objects.



Which of the following velocity vectors best represents the velocity of object X relative to object Y?

- A.
- B.
- C.
- D.

8. The diagram below shows the position of the meniscus of the mercury in a mercury-in-glass thermometer.



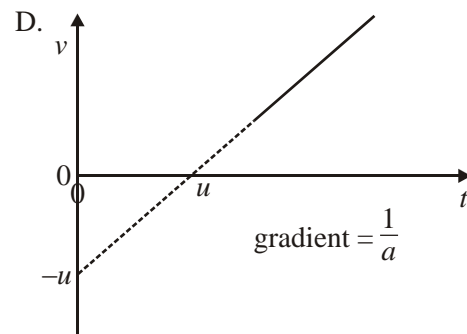
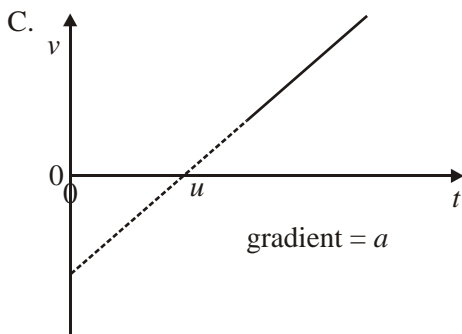
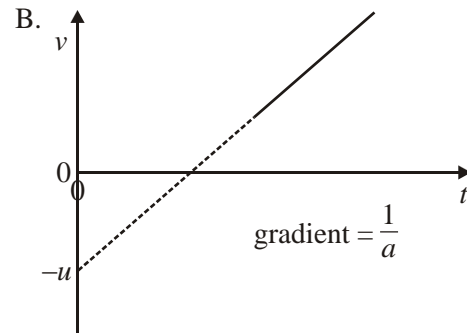
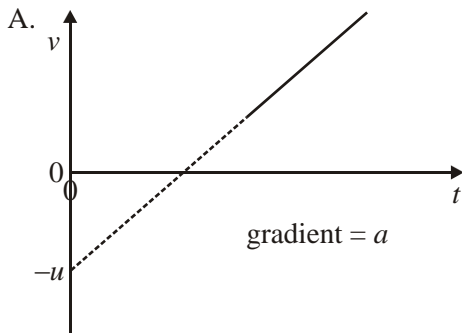
Which of the following best expresses the indicated temperature with its uncertainty?

- A.  $(6.0 \pm 0.5)^\circ\text{C}$   
 B.  $(6.1 \pm 0.1)^\circ\text{C}$   
 C.  $(6.2 \pm 0.2)^\circ\text{C}$   
 D.  $(6.2 \pm 0.5)^\circ\text{C}$
9. The variation with time  $t$  of the speed  $v$  of an object is given by the expression

$$v = u + at$$

where  $u$  and  $a$  are constants.

A graph of the variation with time  $t$  of speed  $v$  is plotted. Which **one** of the following correctly shows how the constants may be determined from this graph?



(1)

10. A ball, initially at rest, takes time  $t$  to fall through a vertical distance  $h$ . If air resistance is ignored, the time taken for the ball to fall from rest through a vertical distance  $9h$  is

- A.  $3t$ .  
 B.  $5t$ .  
 C.  $9t$ .  
 D.  $10t$ .

(1)

11. When a body is accelerating, the resultant force acting on it is equal to its
- A. change of momentum.
  - B. rate of change of momentum.
  - C. acceleration per unit of mass.
  - D. rate of change of kinetic energy.

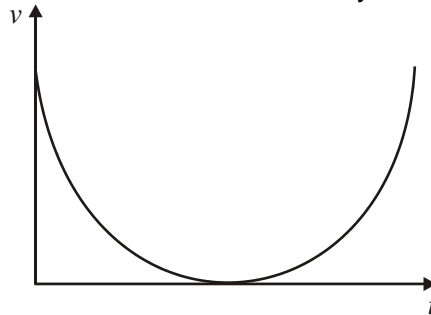
(1)

12. A stone is thrown horizontally from the top of a high cliff. Assuming air resistance is negligible, what is the effect of gravitational force on the horizontal and on the vertical components of the velocity of the stone?

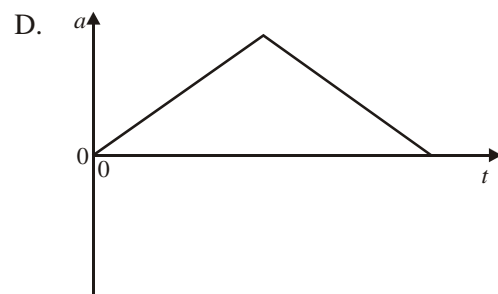
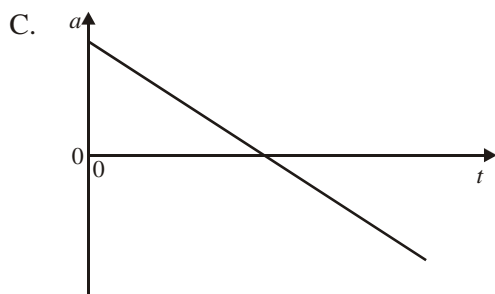
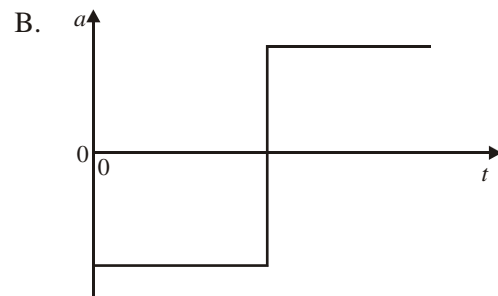
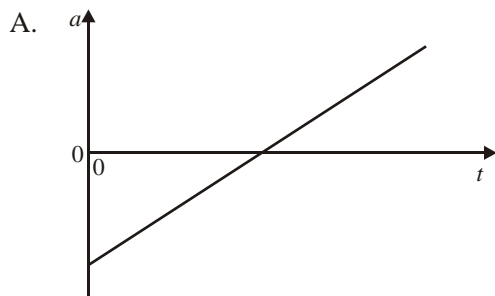
	Vertical component of velocity	Horizontal component of velocity
A.	increases to a constant value	stays constant
B.	increases continuously	stays constant
C.	increases to a constant value	decreases to zero
D.	increases continuously	decreases to zero

(1)

13. The graph shows the variation with time  $t$  of the velocity  $v$  of an object.

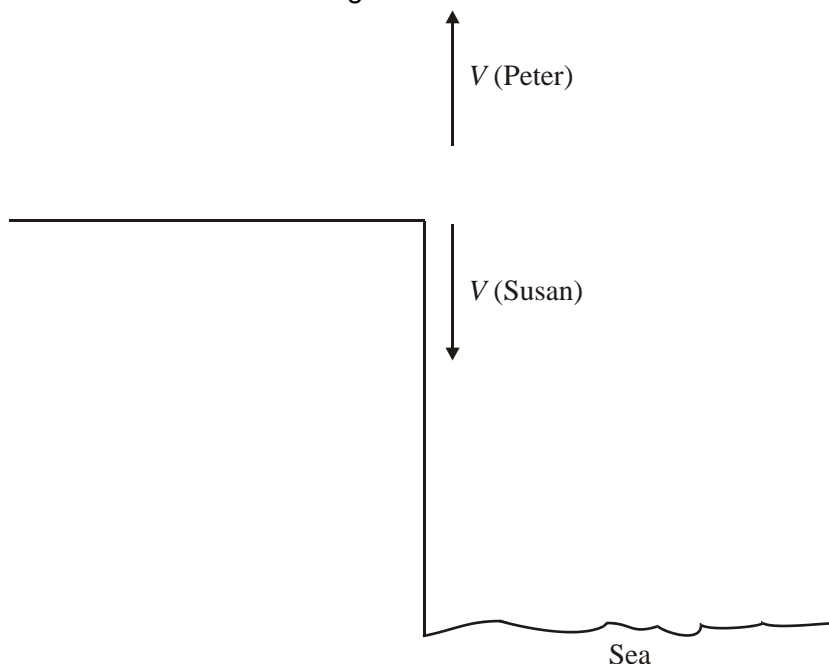


Which **one** of the following graphs best represents the variation with time  $t$  of the acceleration  $a$  of the object?



(1)

14. Peter and Susan both stand on the edge of a vertical cliff.



Susan throws a stone vertically downwards and, at the same time, Peter throws a stone vertically upwards. The speed  $V$  with which both stones are thrown is the same. Neglecting air resistance, which **one** of the following statements is true?

- A. The stone thrown by Susan will hit the sea with a greater speed than the stone thrown by Peter.
- B. Both stones will hit the sea with the same speed no matter what the height of the cliff.
- C. In order to determine which stone hits the sea first, the height of the cliff must be known.
- D. In order to determine which stone hits the sea first both the height of the cliff and the mass of each stone must be known.

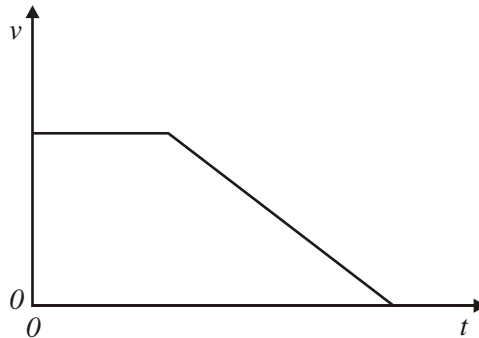
(1)

15. A small boat in still water is given an initial horizontal push to get it moving. The boat gradually slows down. Which of the following statements is true for the forces acting on the boat as it slows down?

- A. There is a forward force that diminishes with time.
- B. There is a backward force that diminishes with time.
- C. There is a forward force and a backward force both of which diminish with time.
- D. There is a forward force and a backward force that are always equal and opposite.

(1)

16. The diagram below shows the variation with time  $t$  of the velocity  $v$  of an object.

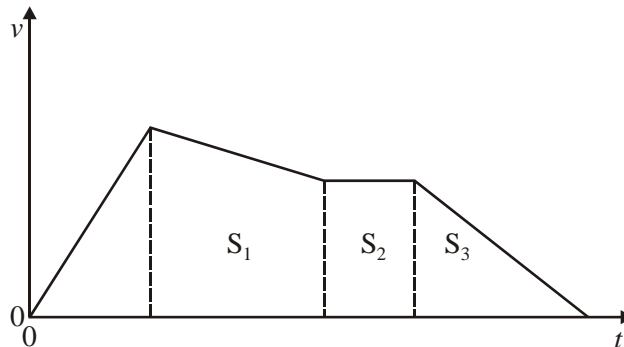


The area between the line of the graph and the time-axis represents

- A. the average velocity of the object.
- B. the displacement of the object.
- C. the impulse acting on the object.
- D. the work done on the object.

(1)

17. The variation with time  $t$  of the speed  $v$  of a car moving along a straight road is shown below.



Which area,  $S_1$ ,  $S_2$  or  $S_3$ , or combination of areas, represents the total distance moved by the car during the time that its speed is reducing?

- A.  $S_1$
- B.  $S_3$
- C.  $S_1 + S_3$
- D.  $S_1 + S_2 + S_3$

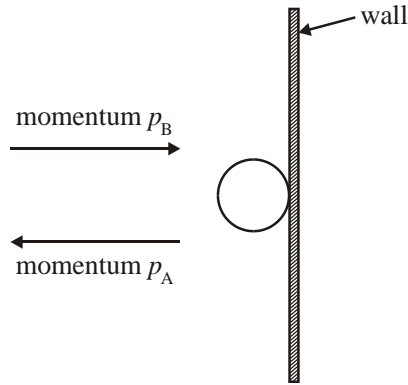
(1)

18. Which of the following quantities are conserved in an inelastic collision in an isolated system of two objects?

	Linear momentum of system	Kinetic energy of system
A.	Yes	Yes
B.	Yes	No
C.	No	Yes
D.	No	No

(1)

19. A sphere of mass  $m$  strikes a vertical wall and bounces off it, as shown below.

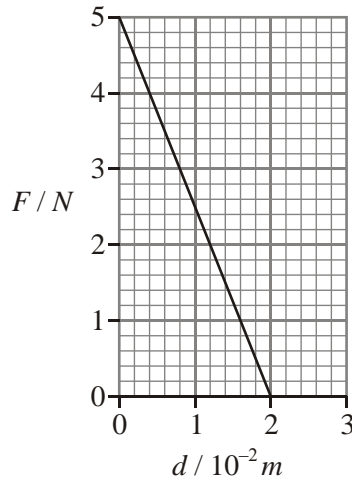


The magnitude of the momentum of the sphere just before impact is  $p_B$  and just after impact is  $p_A$ . The sphere is in contact with the wall for time  $t$ . The magnitude of the average force exerted by the wall on the sphere is

- A.  $\frac{(p_B - p_A)}{t}$ .
- B.  $\frac{(p_B + p_A)}{t}$ .
- C.  $\frac{(p_B - p_A)}{mt}$ .
- D.  $\frac{(p_B + p_A)}{mt}$ .

(1)

20. The graph below shows the variation with displacement  $d$  of the force  $F$  applied by a spring on a cart.

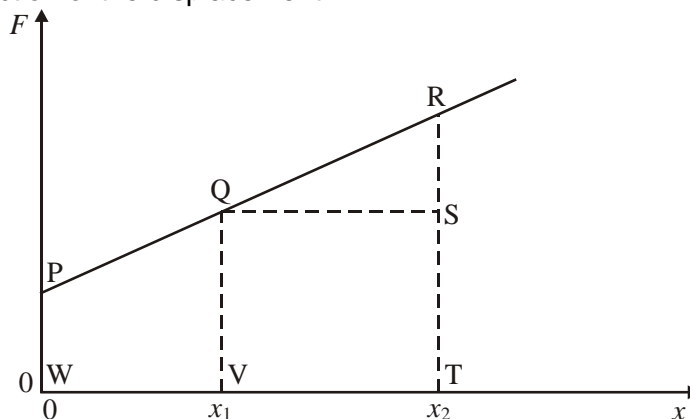


The work done by the force in moving the cart through a distance of 2 cm is

- A.  $10 \times 10^{-2} \text{ J}$ .
- B.  $7 \times 10^{-2} \text{ J}$ .
- C.  $5 \times 10^{-2} \text{ J}$ .
- D.  $2.5 \times 10^{-2} \text{ J}$ .

(1)

23. The diagram below shows the variation with displacement  $x$  of the force  $F$  acting on an object in the direction of the displacement.



Which area represents the work done by the force when the displacement changes from  $x_1$  to  $x_2$ ?

- A. QRS
- B. WPRT
- C. WPQV
- D. VQRT

(1)

24. In the Geiger-Marsden experiment,  $\alpha$  particles are scattered by gold nuclei. The experimental results indicate that most particles are

- A. scattered only at small angles.
- B. scattered only at large angles.
- C. absorbed in the target.
- D. scattered back along the original direction.

(1)

25. Electron-capture is a process that occurs when a nucleus captures an electron from the innermost shell of electrons surrounding the nucleus.

When electron-capture occurs in iron-55 ( ${}^{55}_{26}\text{Fe}$ ), the nucleus is changed into a manganese (Mn) nucleus. Which equation represents this change?

- A.  $({}^{55}_{26}\text{Fe}) + {}^0_1\text{e} \rightarrow {}^{55}_{27}\text{Mn}$
- B.  $({}^{55}_{26}\text{Fe}) + {}^1_1\text{e} \rightarrow {}^{56}_{27}\text{Mn}$
- C.  $({}^{55}_{26}\text{Fe}) + {}^0_{-1}\text{e} \rightarrow {}^{55}_{25}\text{Mn}$
- D.  $({}^{55}_{26}\text{Fe}) + {}^1_{-1}\text{e} \rightarrow {}^{56}_{25}\text{Mn}$

(1)

26. At an atomic scale, which **one** of the following correctly lists the four fundamental interactions in order of **increasing** strength?
- A. electromagnetic, weak, gravity, strong
  - B. weak, gravity, electromagnetic, strong
  - C. gravity, weak, strong, electromagnetic
  - D. gravity, weak, electromagnetic, strong
- (1)
27. Ag-102, Ag-103 and Ag-104 are three isotopes of the element silver.
- Which **one** of the following is a true statement about the nuclei of these isotopes?
- A. All have the same mass.
  - B. All have the same number of nucleons.
  - C. All have the same number of neutrons.
  - D. All have the same number of protons.
- (1)
28. Radioactive decay is a *random* process. This means that
- A. a radioactive sample will decay continuously.
  - B. some nuclei will decay faster than others.
  - C. it cannot be predicted how much energy will be released.
  - D. it cannot be predicted when a particular nucleus will decay.
- (1)
29. The emission and absorption spectra of different elements provides evidence for the existence of
- A. isotopes.
  - B. neutrons.
  - C. protons.
  - D. atomic energy levels.
- (1)
30. The nucleus of an atom contains protons. The protons are prevented from flying apart by
- A. the presence of orbiting electrons.
  - B. the presence of gravitational forces.
  - C. the presence of strong attractive nuclear forces.
  - D. the absence of Coulomb repulsive forces at nuclear distances.