Honors Physics
First Semester Review

Name _____

Notes / Things to remember:

1. On multiple choice questions, make sure to read all the choices especially if the first choice seems correct. The correct answer could be "all of the above"
2. Read all problems carefully, **look at axes labels on graphs**, don't assume anything.
3. For multiple choice problems use 10 m/s^2 for acceleration due to gravity rather than 9.8 m/s^2
4. You can write on the test so draw pictures and diagrams to help you solve problems.

Bring a calculator

Bring a #2 pencil

Graphical Analysis and Scientific Reasoning:

1. Why is physics is the most basic science?

   There are several reasons. Ideas in physics are used in other sciences. Understanding physics helps understand science in general. Physics builds a foundation for chemistry which builds a foundation for biology

2. Describe in detail the steps that are part of the scientific method.

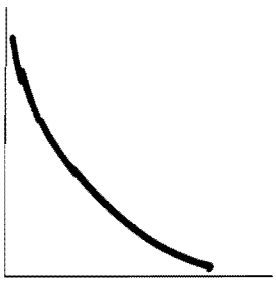
3. What test is used to determine if a scientific hypothesis is a valid hypothesis?

   A hypothesis is valid if a test can be created to prove it wrong.

4. Be able to analyze a scenario and identify the following:

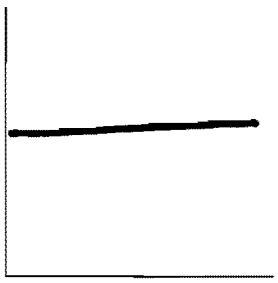
   a) Independent Variable - **The variable that you change in an experiment or lab**
   b) Dependent Variable – **Variable you measure as a result of changes in the Ind. Variable**
   c) What axes are each graphed on? **Independent – X Dependent -Y**
   d) What variables need to be held constant? **Control variables**

5. On the axis below, draw the relationship indicated and write the corresponding general equation on the line below:



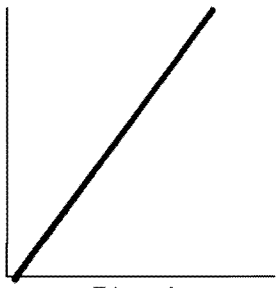
Inversely Proportional

$y = 1/x$



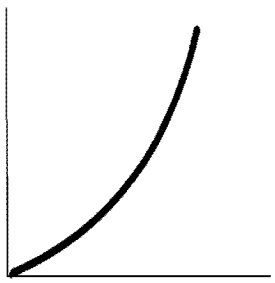
No Relationship

$y = b$



Directly Proportional

$y = mx$

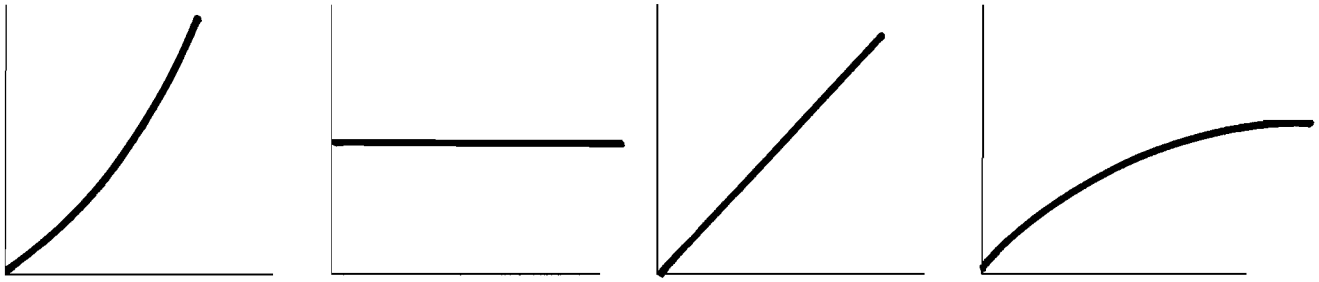


Directly Proportional to x^2

$y = mx^2$

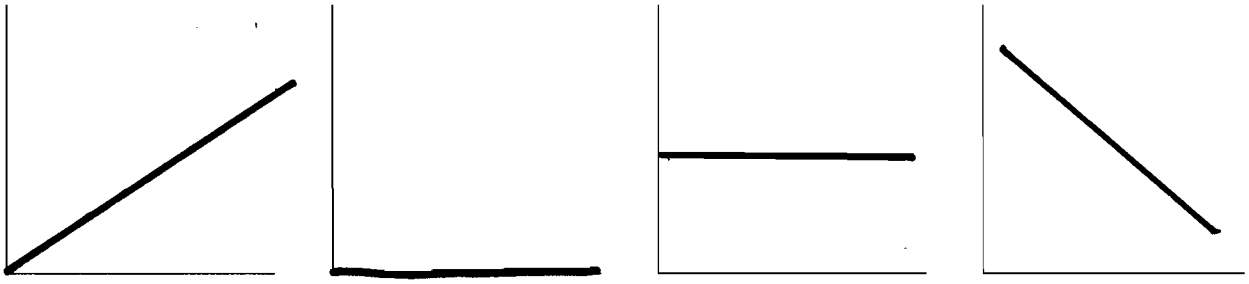
Motion

5. On the axis below, draw the distance time graph for the indicated scenario if the object is:



speeding up | At rest | Constant Velocity | Slowing down

6. On the axis below, draw the velocity time graph for the indicated scenario if the object is:



speeding up | At rest | Constant Velocity | Slowing down

SKATE Boarder

7. The diagram below shows the position of a physics teacher moving through the hall each second.

A)

B)

Which of the following statements accurately describes the teacher's motion when:

a. The teacher is slowing down. **"B" is slowing down**
b. The teacher is speeding up. **"A" is speeding up**
c. The teacher is accelerating. **Both are accelerating**

8. A car is moving in a straight line and steadily increases its speed from 2 m/s to 4 m/s in the first second and from 4 m/s to 6 m/s in the next second. What is the car's acceleration?

$$a = \frac{\Delta V}{\Delta t} = \frac{2}{1} = 2.0\ m/s^2$$

9. An object moving with a velocity of 10 m/s accelerates to a velocity of 40 m/s in 6 seconds. The acceleration is:

$$a = \frac{\Delta V}{\Delta t} = \frac{40-10}{6} =$$

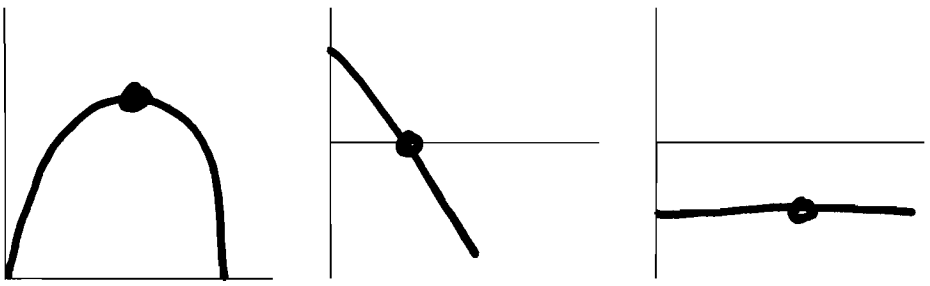
$$a = 5\ m/s^2$$

or $V_i = 10$
$V_f = 40$
$d = *$
$a = ?$
t 6

~~40~~ $V_f = V_i + at$
$40 = 10 + a(6)$
$30 = 6a$
$a = \frac{30}{6} = 5\ m/s^2$

Freefall

10. Draw the displacement time graph, velocity time graph, and acceleration time graph for an object that is thrown straight up in the air:



On each graph, indicate the top of the path and state what the value is at that point.

11. The velocity of a projectile at the peak (top) of its path is?
    Vertical Velocity = 0
    Horizontal is constant

12. The acceleration of a projectile at the peak (top) of its path is?

    -9.8 in the vertical direction.

13. Neglecting friction, a freely falling body starting from rest in 4 sec. will fall a distance of:

V_i: 0
V_f *
$d = ?$
$a = 9.8$
$t = 4$

$$d = \frac{1}{2}at^2 = \frac{1}{2}(9.8)(4)^2 = 78.4\ m$$

14. A ball is dropped from a tower and falls freely without air resistance. What is its velocity after 7 seconds?

$V_i = 0$
$V_f = ?$
d *
a 9.8
t 7

$$V_f = V_i + at$$

$$V_f = 0 + 9.8(7) = 68.6\ m/s \downarrow$$

15. A ball is thrown straight up with an initial velocity of 60 m/s. After 2 seconds, what is the acceleration of the ball?

-9.8 m/s^2 Everywhere

16. A body initially at rest falls under the influence of gravity falls for 10 seconds. How far does it fall?

6 sec

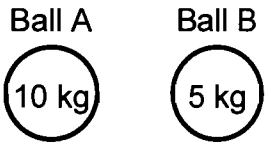
V_i : 0
V_f : #
d : ?
a : 9.8
t : ~~10~~ 6

$d = \frac{1}{2}at^2$

$\frac{1}{2}(9.8)(\cancel{10})^2 = \cancel{490}$ 176m

17. If the two balls to the right were dropped from the same height (Neglecting air resistance), which ball will

a. have the greatest acceleration? **Same**
b. have the greatest velocity after 6 seconds? **Same**
c. have the greatest force of gravity? **Ball "A"**
d. hit the ground first. **Same Time**



Vectors and Forces and Newton's Laws

1. Indicate which of the following are a vector(V) or a scalar(S)

S Mass V Force V Acceleration S Distance S Speed V Velocity S Temperature

2. Two forces of 3 N and 9 N acting on a single point.
   a) What is the minimum value of the vector sum? **6 N**
   b) What is the maximum value of the vector sum **12 N**
   c) How did you obtain the answers above?

   9 ← 3 9 - 3 = 6
   9 + 3 = 12

   d) Draw a diagram of the two vectors whose sum is between "A" and "B"

Newton's Laws

3. State the law of inertia (Newton's first Law)

An object in a constant state of motion (at rest or constant velocity) stays in its state of motion unless acted upon by an outside net force

4. State Newton's second Law

The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. F= ma

5. State Newton's third Law

For every action there is an equal and opposite reaction. These equal and opposite forces are called action reaction pairs.

6. If you had to support your weight on a bed of nails, rank the following from most painful (1) to least painful (5).

__3__ Sitting
__2__ Standing bare foot on two feet.
5 __ Lying down on your back
__1__ Standing bare foot on one foot.
__4__ Lying down on your side.

PRESSURE

6. A 50-kilogram sky diver falls with a wind resistance force of 240 Newton's What is the approximate value of her net force? (Draw a free body diagram)

$F_g = mg = 50(9.8) = 490$

$F_{net} = F_g - F_a$

$490 - 240 = 250N$

8. For the following scenarios, what net force is required? (Zero or non zero)
   a. To start an object moving **Required**
   b. To keep an object moving with a constant velocity **Not Required**
   c. To stop a moving object **Required**
   d. To change an object's direction while keeping its speed constant **Required**
   e. To make an object speed up **Required**
   f. To make an object slow down **Required**

Questions 9 and 10 refer to the following situation.

Two skaters are on a frozen pond standing still facing one another. Skater A (50 Kg) pushes off skater B (35Kg) with a force of 10 N.

9. The force exerted by skater B on skater A will be?

   10N they are the same by Newton's 3rd Law

10. During the push, what are the accelerations of each skater?

$$a_1 = \frac{F_1}{m_1} = \frac{10}{50} = 0.20 m/s^2$$

$$a_2 = \frac{F}{m_2} = \frac{10}{35} = 0.29 m/s^2$$

11. If a group of students is in a tug-of-war, the winning group exert the __**Same**__ force on the rope as the losers. However, the winners exert __**More**____ force against the __**Ground**___. Explain in detail the above scenario.

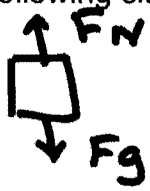
   This is due to the fact that the action reaction pairs act on different objects.

12. If an object is moving to the left, what forces can be acting toward the right?

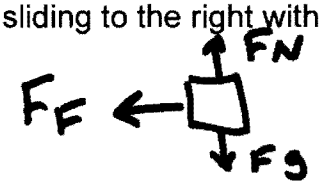
   Any force that might slow the object down Friction, wind resistance

13. Draw a free body diagram for the following situations:

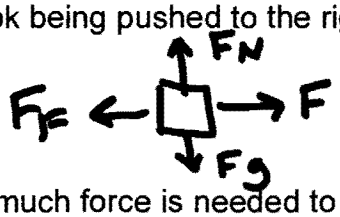
A book sitting on the desk



A book sliding to the right with a friction force



A book being pushed to the right at constant velocity with a friction force



14. How much force is needed to accelerate a 6-kg block of ice from rest to a speed of 12 m/s in 4 seconds?

$V_i = 0$
$V_f = 12$
$d = *$
$a \quad ?$
$t \quad 4$

$V_f = V_i + at$
$12 = 0 + a(4)$
$a = \frac{12}{4} = 3 m/s^2$

$F = ma$
$F = 6 \cdot 3 = 18N$

15. The force required to give a mass of 15 kg an acceleration of 3.0 m/sec^2 is:

$F = ma = 15(3) = 45 N$

16. A man pushes a block of ice across a horizontal surface with a force of 20 Newton's. The resulting acceleration is 2.0 m/sec^2. What is the mass of the block of ice?

$F = ma$
$20 = m(2)$

$m = \frac{20}{2} = 10 Kg$

17. The gravitational force of the earth on an object is often called its___**Weight**__. What is the force of gravity on a 46 kg physics student?

$F_g = mg = 46(9.8) = 451 N$

Projectiles:

1. Describe the horizontal motion of a projectile.

   It is a constant velocity problem

2. Describe the vertical motion of a bomber problem.

   It is the same as a freefall problem where a ball is dropped from some height, it accelerates due to gravity at -9.8 m/s^2

3. Describe the vertical motion of a cannon problem.

   It is the same motion as a ball tossed straight up into the air. It slows down on its way to the top due to gravity and accelerates on the way back down

4. Describe the Velocity at the peak of a cannon problem.

   It has only horizontal velocity

5. What could be done in order to obtain the longest possible range of a projectile using some sort of projectile shooter.

   Shoot at 45° and maximize the launch velocity

6. Two tennis balls of equal mass are rolled off the edge of the lab desk. If the balls have different speeds and leave the edge of the table at the same instant.
   a. Which ball will hit the ground first? **They hit at the same time**
   b. Which ball will land furthest from the base? **The faster ball**

7. A cliff diver dives off a cliff that is 20.0 m high. There are several rocks at the bottom of the cliff that extend out into the water. In order to clear the rocks, the diver must get a running start off the cliff with a velocity of 5.0 m/s How far from the base of the cliff does the diver land?

	x	y
v_i	5	0
v_f	5	*
d	?	20
a		9.8
t	2.02	

$$d = \frac{1}{2} a t^2$$

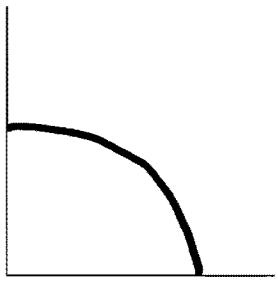
$$20 = \frac{1}{2}(9.8)t^2 = 4.9t^2$$

$$t^2 = \frac{20}{4.9} = 4.08$$

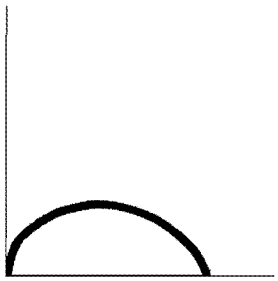
$$t = \sqrt{4.08} = 2.02 \text{ Sec}$$

$$d = v \cdot t = 5 \times 2.02 = 10.1 \text{ m}$$

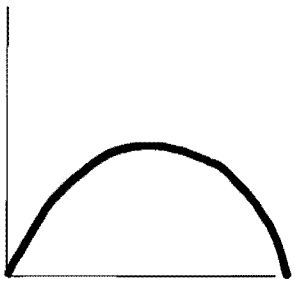
8. A projectile is shot from a marble launcher with the same initial velocity. Draw the path of the projectile for each of the situations below:



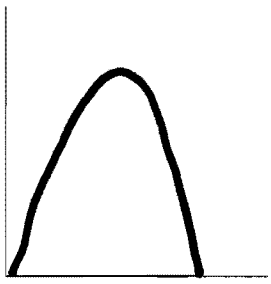
Shot Horizontally off the desk



Shot at 20 degrees



Shot at 45 degrees



Shot at 70 degrees