WJCC School Closure Learning Plan - PHYSICS

Dear WJCC Families,

We are facing significant challenges throughout our nation due to the COVID-19 pandemic. As a result, WJCC Schools will be closed for the remainder of the academic year per the direction of Governor Northam. The Virginia Department of Education will provide guidance on continued teaching and learning over the next few days.

Throughout this time, we will continue to provide resources and activities to support learning. The resources in this packet will help your child practice important skills and review content. This supplemental packet should support learning activities from March 30th – April 3rd. Additional resources may be posted on Student VUE for certain subjects. Students are encouraged to check Student VUE during this time.

This work is not required, and it will not be graded. We simply want families to have access to materials and options during our mandated school closure.

We will be in touch soon with our direction for the remainder of the school year. We hope everyone remains safe and healthy.

Sincerely,
WJCC Staff

Physics Suggested Sequence: Complete **5** of the 8 learning activities below which review material covered in your course. Should you wish to further extend your learning, you may complete the additional activities.

Activity 1	**Activity 2**	**Activity 3**	**Activity 4**	**Activity 5**
Scientific Investigation: Complete the Scientific Investigation Review	One Dimensional Motion: Complete the Motion in One Dimension Questions	Free Fall Kinematics: Complete the Free Fall Kinematics Review and discussion questions.	Horizontal Projectile Kinematics: Complete the Horizontal Projectile Review	Projectile Kinematics: Complete the two projectile challenge problems.

Online Activity 1	**Online Activity 2**	**Online Activity 3**
https://www.khanacademy.org/math/arithmetic-home/arith-review-decimals/arithmetic-significant-figures-tutorial/v/significant-figures Complete the lesson and the review at the end of the lesson.	https://www.youtube.com/watch?v=XlFhOygrDoM Watch the video on the relation between gravity and free fall. Go through the free fall problem in the video and copy it down for review	http://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_en.html Move the cannon so it has NO angle with the horizon. Complete the intro and answer the following questions: 1.What happens to the motion of the object when you change launch speed? 2.What happens if you change the height at which you launch the projectile? 3.Change the projectile (upper left). When you launch it and don't change the speed of launch height does it land in the same spot as the other projectile? What does this tell you about mass and its relation to horizontal kinematics? 4.Calculate the time and distance the projectile goes if the launch angle is 0 degrees, height is 5m and launch velocity is 15m/s (use simulation if stuck).

ACTIVITY 1

Scientific Investigation Review:

Instructions: In order to review general scientific investigation processes you will need to create a mock lab that is reflective of some concept we have already covered in class.

Step 1: Choose one content to create a lab for:

- Motion in one Dimension (Velocity, Displacement and Acceleration)
- Free Fall
- Horizontal Projectiles
- Full Projectiles
- Accuracy and Precision
- Vectors

Step 2: Brainstorm a Lab in which you prove a concept from the content chosen. What is the purpose of the lab? What should individuals who complete your lab understand by the time they have finished?

Step 3: What would be the materials needed for the lab? Draw a diagram of your set-up and label all measurements that you will make in this part.

Step 4: What would be the IV and DV of your experiment?

Step 5: Outline a procedure that can be followed in order to make the necessary measurements. What sort of data would you collect and why? Create a data table.

Step 6: How would they analyze data and identify sources of error?

ACTIVITY 2

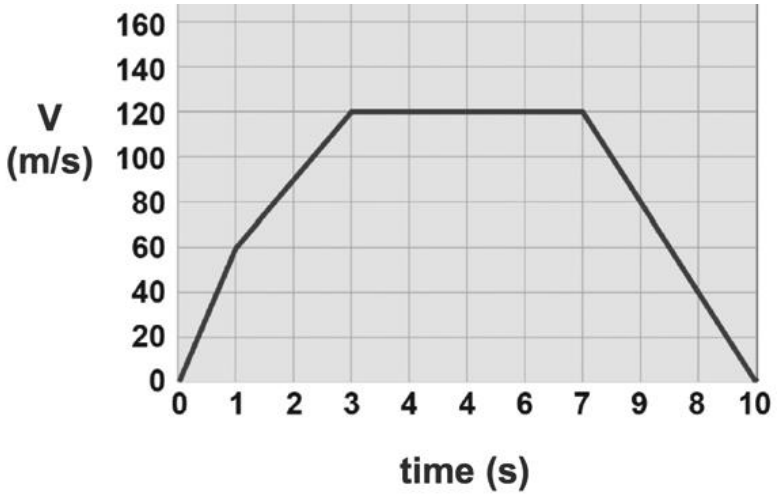
Review of Motion:

Instructions: Please answer the following questions.

1. The rate of change of velocity is _____
2. Slope of a position vs time graph represents _____
3. Slope of a velocity vs time graph represents _____
4. Area under a velocity vs time graph represents _____
5. Area under an acceleration vs time graph represents _____

6. Circle the correct sign of the acceleration in each of these cases:
   a) An object speeding up in the positive direction has (positive) (negative) acceleration.
   b) An object slowing down in the positive direction has (positive) (negative) acceleration.
   c) An object speeding up in the negative direction has (positive) (negative) acceleration.
   d) An object slowing down in the negative direction has (positive) (negative) acceleration.

7. The motion of an object along a straight line is depicted in this graph. What is the acceleration of the particle during each of these time intervals? Show your work.



   a. 0 seconds to 1 second? _

$$a = \frac{v_f - v_i}{t_f - t_i} =$$

   b. 1 seconds to 3 seconds? _

$$a = \frac{v_f - v_i}{t_f - t_i} =$$

   c. 3 seconds to 7 seconds? _

$$a = \frac{v_f - v_i}{t_f - t_i} =$$

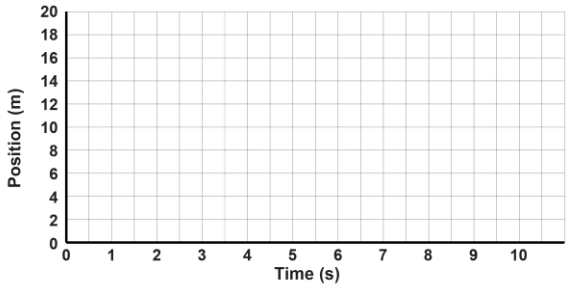
   d. 7 seconds to 10 seconds? _____

$$a = \frac{v_f - v_i}{t_f - t_i} =$$

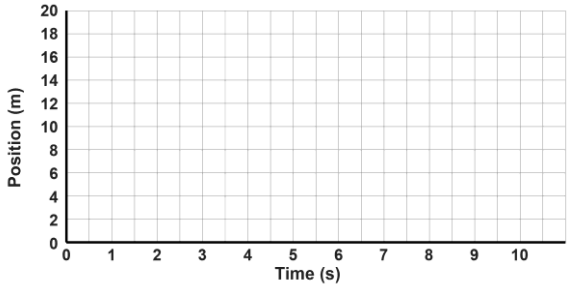
8. Circle the correct answer:
   a) Constant Acceleration creates a (line of constant slope) (curve) on a *v* vs. *t* graph.
   b) Changing Acceleration creates a (line of constant slope) (curve) on a *v* vs. *t* graph.

9. Circle the correct answer:
   a) When acceleration is positive, the *v* vs. *t* graph has a (zero) (positive) (negative) slope.
   b) When acceleration is negative, the *v* vs. *t* graph has a (zero) (positive) (negative) slope.

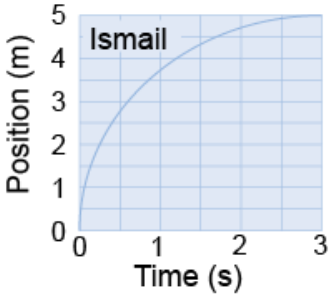
10. Sketch a position time graph that shows positive acceleration.

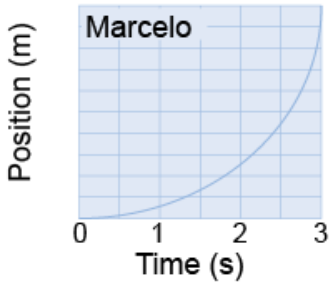


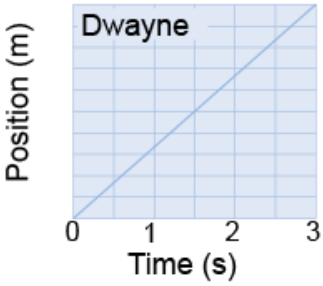
11. Sketch a position time graph that shows negative acceleration.



12. The position–time graphs of three sprinters are shown below. Which sprinter best matches each of the following statements?

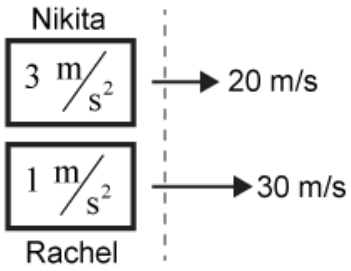






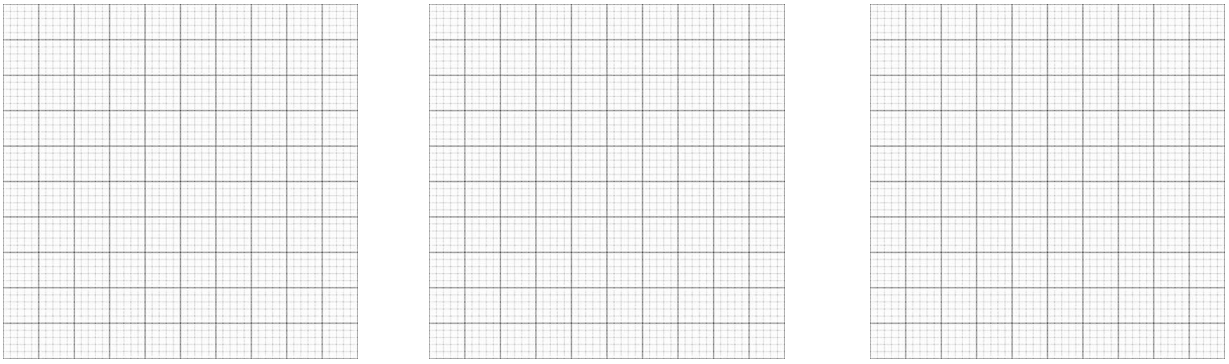
   a. "I underwent positive acceleration during the three-second interval shown."
   b. "I underwent negative acceleration during the three-second interval shown."
   c. "I underwent zero acceleration during the three-second interval shown."

13. Nikita and Rachel are driving their new cars westward on the highway. At the very same instant, they cross the Weston town line (call it $t = 0$). Nikita's velocity is 20 m/s westward at that moment, while Rachel is going faster at 30 m/s (in the same direction). Each driver is accelerating westward: Nikita at 3 m/s^2, and Rachel at 1 m/s^2. They maintain these accelerations for 10 s (until $t = 10$ s).



Note: These problems can be solved either by using graphs or by using algebra.

Nikita: Rachel: Both:



a. At what time t are Nikita and Rachel equally fast?

b. At that time (when they are equally fast), who has gone farther from the town line?

c. After 10 s has passed (that is, at $t = 10$ s), who is farther from the town line?

ACTIVITY 3

Free Fall Kinematics Review:

Instructions: Below is an advertisement from a North Carolina skydiving company. Read the advertisement and then answer the discussion questions relating to free fall motion.

SKYDIVING FREEFALL: WHAT TO EXPECT?

Most people have dreamed about flying, but how many of us can say we actually know what it feels like to fly in real life?

Well, actually, thousands of people know that feeling! Because every year, thousands of people try skydiving for the very first time – and there's really no experience closer to flying than freefall! Here's our guide to skydiving freefall and what you can expect when you try skydiving yourself

Photo credit (above): Cristobal Correa

WHAT IS SKYDIVING FREEFALL?

The term 'freefall' refers to the part of a skydive where you're not using your parachute, you're simply falling through the sky, with nothing to hold you back. It's called 'freefall' because you literally are free; there are no constraints, no bungee cords, nothing but the open air and the wind in your face. It's completely exhilarating!

HOW LONG DOES SKYDIVING FREEFALL LAST?

Freefall starts as soon as you leave the airplane, and continues until your instructor releases your parachute. The way we work out how long you'll be in freefall is based on two things; your exit altitude (how high you are when you jump) and your freefall speed (the rate at which you're falling). A typical skydiving jump height is anywhere between ten and fifteen thousand feet – here at Skydive Carolina, it's usually around 14,000 feet.

Based on a typical skydiving freefall descent rate (which we'll tell you about in a moment), it takes around 10 seconds to fall the first thousand feet then five seconds thereafter. So from 14,000 feet, opening your parachute around 5,000 feet, you'll fall for about fifty seconds. During that time, you're totally able to breathe, relax, take in your surroundings and, if you have paid for a videographer to film your jump, you'll be able to give your camera flyer a nice wave and a smile, too.

HOW FAST DO YOU FALL DURING FREEFALL?

Typically, a tandem skydiver will fall at around 120mph.

Yes, that's right – 120mph! That's faster than you've ever driven your car, likely faster than most of us have travelled aside from taking an airplane flight or any particularly quick roller coasters!

It's normal for first-time skydivers to assume that such high speeds of descent would feel, well… quick. But the reality is, it doesn't.

The only time you really feel like you're falling is just after you exit the aircraft. For the first few seconds, you're accelerating to what's called your 'terminal velocity', which is the fastest speed you'll reach. Once you get to that terminal velocity, you stop accelerating and that sensation of descent is replaced with one of being 'cushioned' by the air. It doesn't feel fast. It feels like floating. It's as close as you're going to get to real human flight. It's addictive!

Discussion Questions:
Verify the following statements given by the advertisement.

1. The article mentions that freefall is called 'freefall' because you literally are free. Is this true? Why? What is the proper definition of freefall motion?

2. Is it possible to "fall up"? Explain your reasoning.

3. The article says "Based on a typical skydiving freefall descent rate it takes around 10 seconds to fall the first thousand feet". If you start at 10,000 feet in the air and drop straight down. Verify this statement, is it accurate to your calculation?

ACTIVITY 4

Horizontal Projectile Kinematics Review

Instructions: Read the scenario below and answer the conceptual questions that accompany it. Each answer should have a picture to accompany it.

Scenario:

A cannon is fired from a height of 1 meter with an initial horizontal velocity of 5 m/s. Answer the following questions:

Draw a picture:

A. At what point has the projectile reached its maximum height and how do you know?

B. What is the initial velocity in the x and y direction?

C. How long was the cannon ball in the air?

D. Are there x and y components for the final velocity?

E. Calculate final velocity of the cannon ball.

F. What is the acceleration in the y direction, why is it this value? Could this be changed? How?

G. What is the acceleration in the x direction? Explain your reasoning.

H. Calculate the range of the cannon.

I. What would happen to the range of the projectile if we increase or decrease the height it was launched from? Explain your reasoning.

J. What would happen to the range of the projectile if we increased or decreased the initial velocity? Explain your reasoning.

K. What would happen to the range of the projectile if we fired the cannon at angle larger than 0^0 ? Explain your reasoning.

ACTIVITY 5

Projectile Motion Review:

Challenge Problems

Instructions: Complete each problem! Always start with drawing a picture! Remember to convert into standard SI units!

1. A rocket is fired from a 15m platform to ground level with an initial velocity of 850 km/hr. The rocket launches at a 30^0 angle and is on the planet Titan where the **acceleration of gravity** is 1.352 m/s^2. How far will the rocket go before it lands?

2. A skydiver jumps at a 45^0 angle downward from a plane with an initial velocity of 20 m/s. If the sky diver jumped from a height of 50,000 feet how long did it take him to reach ground level?