Science 10

Name:____**KEY**_______________
Block:____ Date:______________

Chapter 9 Review

1. A change in velocity occurs when the ___**speed**__ of an object changes, or its __**direction**____ of motion changes, or both. These changes in velocity can either be ___**positive**___ or ___**negative**___.
2. To calculate a change in velocity, subtract the ___**initial**___ velocity from the __**final**___ velocity.
3. Calculate the change in velocities of the following objects:
   a) A boy is skiing forward down the mountain at 8m/s. He reaches a steeper part of the mountain and increases his velocity to 15m/s.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (+15m/s) - (+8m/s) = +7m/s$

   b) A car is moving forward at 50km/h. A young child runs across the street and the car slows to 30km/h.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (+30km/h) - (+50km/h) = -20km/h$

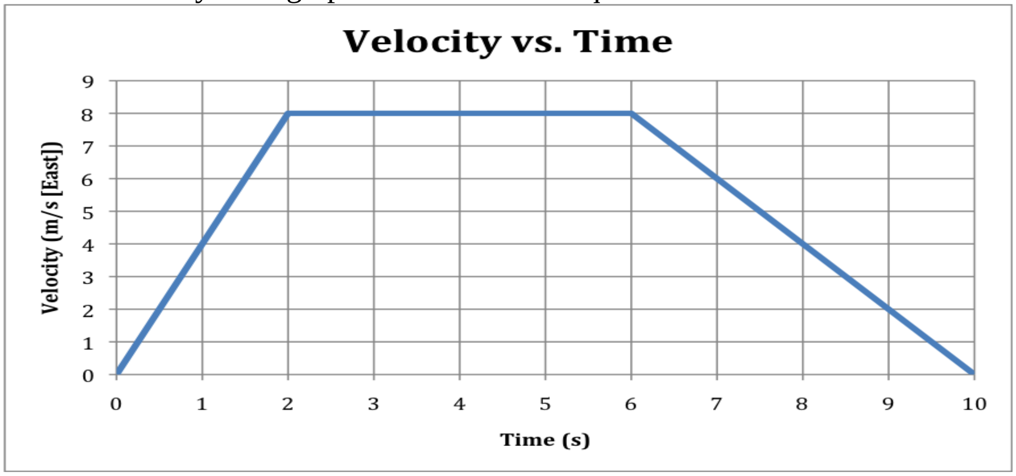
   c) A young girl hits a tennis ball forward at a wall at 20m/s. The ball rebounds off the wall at 15m/s back towards the girl.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (-15m/s) - (+20m/s) = -35m/s$

   d) A train is travelling forward at 30m/s. After some time passes, the train has not changed velocity and is still moving forward at 30m/s.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (+30m/s) - (+30m/s) = 0m/s$

4. A ___**positive**__ change in velocity results when an object that is already moving in a forward direction ___**increases**__ its velocity in the same (forward) direction.
5. A __**negative**___ change in velocity results when an object that is already moving in a forward direction __**decreases**__ its velocity in the same (forward) direction.
6. If your initial and final velocities are ___**equal**___, then your change in velocity would be __**zero**____ and you would be moving at a ____**constant**___ velocity.
7. If velocity is constant your motion is said to be __**uniform**___, and if your velocity is changing (either positive or negative), your motion is said to be __**non-uniform**__.
8. ___**Acceleration**____ is the rate at which an object changes its velocity.
9. Like velocity, acceleration is also a ___**vector**___ quantity, meaning you must specify both magnitude and ___**direction**____ when recording an object's acceleration.
10. When comparing the acceleration of __**two different objects**___, the object that changes its velocity in a shorter time interval or has a greater change in __**velocity**____ during the time interval, is said to have a ___**greater**____ acceleration.
11. There are two types of acceleration, ____**positive**____ and _____**negative**____.
12. If a car is moving forward and increases it's velocity in the forward direction, the acceleration is said to be __**positive**___. If a car is moving forward and ___**decreases**____ it's velocity in the forward direction the acceleration is said to be ___**negative**_____.
13. Acceleration which causes the object to decrease its speed is sometimes called ____**deceleration**___.
14. Positive and negative acceleration both depend upon the ___**direction**___ that the object is initially moving. Generally, we define an object moving forward as ___**positive**___ and an object moving backward as ___**negative**___.
15. If the change of velocity of an object is positive it's said to be accelerating ___**forward**__ or positively, if the change of velocity of an object is negative it's said to be accelerating ___**backward**___ or negatively.

16. A train is travelling forward at 20m/s, stops and backs up at 5m/s. What is the train's change in velocity and what is the direction of the train's acceleration?
    - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (-5m/s) - (+20m/s) = -25m/s$
    - **The direction of the train's acceleration is backwards**
17. If the acceleration of an object is in the same direction as the velocity, what happens to the velocity of the object?
    - **If an object accelerates in the same direction that the object is already moving, then the object's velocity will increase.**
18. If the acceleration of an object is in the opposite direction as the velocity, what happens to the velocity of the object?
    - **If an object accelerates in the opposite direction to the velocity, then the object's velocity will decrease.**
19. Describe the concept behind having airbags in automobiles (be sure your description includes the acceleration that occurs in a car accident.)
    - **The driver of a car is moving at the same velocity as the car when driving. When you get into a car accident, the car and the driver both decelerate to zero very quickly**.
    - **The idea behind airbags is to prolong the stopping time that occurs when you get into a car accident. When you hit the air bag your change in velocity takes a longer period of time as compared to simply striking the dashboard or the car. This results in a smaller acceleration.**
    - **If your acceleration is smaller, there is less chance of injury.**
20. Position-time graphs can be used to ___**represent the motion**____ of an object travelling at constant velocity or ___**changing**___ from constant velocity to another. Velocity-time graphs can be used instead to represent motion of an object whose velocity is ___**changing**___. Velocity-time graphs provide information about an object's ___**velocity**___ and ___**acceleration**___.
21. The slope of a line on a velocity-time graph represents the ______**change**______ in the object's velocity. ___**Change in velocity**________ is also known as acceleration, therefore the slope of a velocity-time graph also represents an object's ____**acceleration**____.
22. Describe how you would calculate an object's acceleration using the slope of a velocity-time graph.
    - **Slope can be calculated by calculating the change in velocity over a time interval and dividing it by that time interval.**
    - **Since the slope of a velocity-time graph equals the acceleration,** $\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{rise}{run}$
23. The SI unit for acceleration is __**m/s^2**__.
24. Describe what is occurring to an object that is accelerating forward at $5.0m/s^2$.
    - **When an object is accelerating at $5.0m/s^2$ it is increasing its velocity 5.0m/s every 1.0s that passes by.**
    - **After 2 seconds the object has increased its velocity twice by 5m/s, giving the object a velocity of 10m/s if it started at rest.**
25. If an object's velocity is changing at a constant rate, it has a ___**constant**__ acceleration.
26. __**Average**____ acceleration is represented by the slope of a velocity-time graph.

Use the velocity-time graph below to answer question 27.



27. For each of the time intervals below, describe the velocity and acceleration of the object.
   a) 0s – 2s
      - **The object starts at rest and increases its velocity at a constant rate until it reaches 8m/s [E].**
      - **The object's acceleration is forward (east) and positive (+4m/s^2).**
   b) 2s – 6s
      - **The object's velocity stays constant at 8m/s [E] for this time interval.**
      - **The object's acceleration is zero.**
   c) 6s – 10s
      - **The object starts at 8m/s [E] and decreases its velocity at a constant rate until it reaches 0m/s.**
      - **The object's acceleration is backward (west) and negative (-2m/s^2).**

28. Calculate the acceleration of the following objects:
   a) A woman riding a bicycle is travelling forward at 5m/s and increases her velocity to 20m/s in 5s.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (+20m/s) - (+5m/s) = +15m/s$
      - $\vec{a} = \dfrac{\Delta\vec{v}}{\Delta t} = \dfrac{+15m/s}{5s} = 3m/s^2$
   b) You throw a tennis ball at a wall and it hits the wall going 25m/s. The ball rebounds off the wall at 15m/s back towards you in 0.5s.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (-15m/s) - (+25m/s) = -40m/s$
      - $\vec{a} = \dfrac{\Delta\vec{v}}{\Delta t} = \dfrac{-40m/s}{0.5s} = -80m/s^2$
   c) You are driving a car at 20m/s. Suddenly a dog runs out in front of your car and you slow to a stop in 2s.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (0m/s) - (+20m/s) = -20m/s$
      - $\vec{a} = \dfrac{\Delta\vec{v}}{\Delta t} = \dfrac{-20m/s}{2s} = -10m/s^2$

29. You can also use an acceleration to calculate either a ____**change in velocity**_____ or __**time**__. If you know acceleration and change in time, you ___**multiply**___ acceleration by time to calculate the change in velocity. If you know acceleration and change in velocity, you __**divide**___ change in velocity by acceleration to calculate the change in time.

30. Calculate the change in velocity of the following objects:
   a) A runner at rest accelerates forward at $2.0m/s^2$ for 6s.
      - $\Delta\vec{v} = (\vec{a})\times(\Delta t) = (+2m/s^2)\times(6s) = +12m/s$
   b) A car screeches to a halt with a negative acceleration of $-15m/s^2$ in 1.5s.
      - $\Delta\vec{v} = (\vec{a})\times(\Delta t) = (-15m/s^2)\times(1.5s) = -22.5m/s$
   c) A baseball that is hit by a bat. The ball experiences an acceleration of $200m/s^2$ for 0.25s.
      - $\Delta\vec{v} = (\vec{a})\times(\Delta t) = (+200m/s^2)\times(0.25s) = +50m/s$
31. Calculate the time interval of the following scenarios:
   a) A car moving 20m/s forward slows to a stop. If the car decelerates at $5m/s^2$, how long does it take for the car to come to a stop?
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (0m/s)-(+20m/s) = -20m/s$
      - $\Delta t = \frac{\Delta\vec{v}}{\vec{a}} = \frac{-20m/s}{-5m/s^2} = 4s$
   b) A train going 20m/s increases its velocity to 40m/s in the same direction. If the train accelerates at $4m/s^2$, how long does the train accelerate for?
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (+40m/s)-(+20m/s) = +20m/s$
      - $\Delta t = \frac{\Delta\vec{v}}{\vec{a}} = \frac{+20m/s}{+4m/s^2} = 5s$
   c) A girl on rollerblades is travelling 9m/s in the forward direction; she slows down to 2m/s in the same direction, how long does she decelerate for if she decelerates at $1m/s^2$?
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (+2m/s)-(+9m/s) = -7m/s$
      - $\Delta t = \frac{\Delta\vec{v}}{\vec{a}} = \frac{-7m/s}{-1m/s^2} = 7s$
32. **__Gravity__** is an attractive force that acts between two or more objects. The most common example of which is between any object near the Earth and the Earth itself.
33. Gravity is a constant **___negative__** acceleration that objects experience when they fall freely near the Earth's surface.
34. Describe the velocity and acceleration that a ball experiences from the time it is tossed in the air until it hits the floor.
      - **When a ball is thrown in the air it has an initial positive velocity (positive being up in direction.)**
      - **Gravity starts acting on the ball the moment it leaves your hand. The acceleration is negative and constant and acts on the ball the entire process.**
      - **The ball slows in velocity and when it reaches its maximum height, it has a velocity of zero, after which the ball starts increasing its velocity negatively (negative being down in direction) until it hits the floor.**
35. Objects that are dropped that have different masses accelerate at the **___same__** rate.
36. Today we understand that two objects dropped from the same height should hit the ground at the same time regardless of the their masses. Describe why a flat piece of paper might take longer to hit the floor if it was dropped at the same height and at the same time as a tennis ball.
      - **The reason that a flat piece of paper may take longer to hit the floor than the tennis ball may be attributed to air resistance.**
      - **Air resistance is a friction-like force that opposed motion of objects that move through the air. Since the piece of paper has more surface area for air resistance to act on, it may take longer to hit the ground than the tennis ball.**

37. **__Galileo___** first proposed that in the absence of air resistance, all objects regardless of their weight, fall at the **______same constant acceleration____________**. This type of acceleration is called acceleration due to **_____gravity____**. The value of which is **____9.8m/s^2______** downward.

38. Calculate the change in velocity of the following objects:
   a) A man jumps off a diving board and hits the pool water below 2s later.
      - $\Delta\vec{v} = (g)\times(\Delta t) = (-9.8m/s^2)\times(2s) = -19.6m/s$

   b) A rock is dropped off a cliff and hits the ground 5s later.
      - $\Delta\vec{v} = (g)\times(\Delta t) = (-9.8m/s^2)\times(5s) = -49m/s$

39. Calculate the time interval for the following scenarios:
   a) A man jumps off a diving board and hits the pool water below with a velocity of 25m/s.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (-25m/s) - (0m/s) = -25m/s$
      - $\Delta t = \frac{\Delta\vec{v}}{\vec{a}} = \frac{-25m/s}{-9.8m/s^2} = 2.6s$

   b) A girl is on a trampoline. She jumps up with a velocity of 12m/s and lands on her way down with a velocity of -12m/s.
      - $\Delta\vec{v} = \vec{v}_f - \vec{v}_i = (-12m/s) - (+12m/s) = -24m/s$
      - $\Delta t = \frac{\Delta\vec{v}}{\vec{a}} = \frac{-24m/s}{-9.8m/s^2} = 2.4s$

<u>Vocabulary to Know:</u>

Write a concise definition of each of these terms found in this chapter.

Acceleration due to gravity:

Acceleration:

Air resistance:

Average acceleration:

Change in velocity:

Constant velocity:

Constant acceleration:

Deceleration:

Gravity:

Negative change in velocity:

Negative acceleration:

Positive acceleration:

Positive change in velocity:

Velocity-time graph:

<u>Symbols to Know:</u>

Indicate what each of the following symbols represent and whether they are a scalar quantity or a vector quantity.

- $\vec{a}$ **acceleration (vector)**
- Δt **time interval (scalar)**
- $\vec{v}_i$ **initial velocity (vector)**
- $\vec{v}_f$ **final velocity (vector)**
- $\Delta\vec{v}$ **change in velocity (vector)**