Name _____ Date _____ Physical Science Period _____

Chapter 11 & 12 Study Guide: Motion & Forces Answer Key

Chapter 11: Motion

1. Define *(include the formula and circle diagram for calculating speed, velocity, and acceleration)*:
   a. Distance: The length between two objects or the length of the path traveled.
   b. Speed: distance traveled by the time it took to travel. **speed = distance/time**
   c. Velocity: distance traveled by the time it took to travel and the direction that you traveled in. **velocity = distance/time**
   d. Acceleration: change in velocity or velocity over time. $acceleration = \frac{velocity_{final} - velocity_{inital}}{time}$
2. What is the speed of an object at rest? 0 m/s
3. The difference between speed and velocity is that velocity includes direction.
4. The SI unit for distance is meter (m).
5. The SI unit for speed or velocity is meter per second (m/s).
6. The SI unit for acceleration is meter per second squared (m/s^2).
7. On a **distance-time** graph, what does the slope tell you? Speed or Velocity
8. On a **speed-time** graph, what does the slope tell you? Acceleration

Chapter 12: Forces

9. **Describe** (what does it say and what is it commonly called)
   a. Newton's First law of Motion: Also known as "Law of Inertia". Object in motion stays in motion and an object at rest stays at rest UNLESS acted upon by a NET FORCE.
   b. Newton's Second law of Motion: F = m x a. Force equals the product of an object's mass and acceleration. (Acceleration is equal to the force and inversely proportional to mass)
   c. Newton's Third law of Motion: Also known as "Action/Reaction Law". For every action there is an equal and opposite reaction.
10. Give **an example for each** of Newton's laws
    a. Newton's First law of Motion: boulder won't move unless something pushes on it, and the moon won't stop rotating unless a force acts on it.
    b. Newton's Second law of Motion it takes more force to accelerate a school bus than a toy car.
    c. Newton's Third law of Motion: my foot pushed on the ball (action force), the ball pushes back (reaction force) and fly's forward (resulting net force). OR when you sit in the desk you push down on the desk and the desk pushes on you but they are balanced so there is NO CHANGE in motion.
11. **Define and give an example of each of the following terms.**

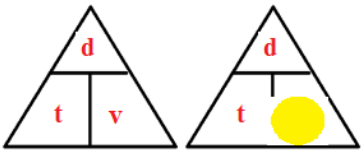
Definition	Example
a. Friction: force that opposes motion.	a. Friction: heat when rubbing hands together.
b. Static Friction: friction that prevents object from moving.	b. Static Friction: pushing against a dresser that won't move.
c. Sliding Friction: friction that occurs between objects sliding past each other.	c. Sliding Friction: going down a slide; dresser sliding across the floor.
d. Rolling Friction: friction that occurs between object rolling against another object.	d. Rolling Friction: roller skates on pavement; car driving on the road
e. Fluid Friction: friction that occurs in a fluid (Examples of Fluid: water, quicksand, air.)	e. Fluid Friction: falling leaves; fish swimming in water
f. Net force: the sum of the forces on an object that	f. Net force: kicking a ball and it flies

is NOT balanced.	across the room.

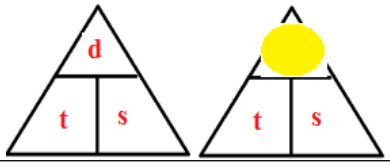
12. Can an object accelerate if there are no net forces? No, if no net force then there is no change in motion (it does not speed up, slow down, or change direction).
13. Can an object be moving with no net force? Yes if it was already in motion (Newton's 1st Law)
14. If forces are unbalanced, is there acceleration? Yes, a force is acting on the object so it's motion will change and accelerate (+ acceleration = speeding up, - acceleration = slowing down)
15. The combination of all of the forces acting on an object is called the Net Force.
16. If the net force acting on a stationary object is zero, then the object will remain stationary (Newton's 1st Law).
17. A car on cruise control is an example of (**balanced**/unbalanced) forces.
18. When the mass of one of two objects increases, the force of gravity between the two objects also increases (gravity goes up when mass goes up, and gravity goes down when distance goes up).
19. The law that states that every object maintains constant velocity unless acted on by an unbalanced force is Newton's 1st Law.
20. The law that states that for every action force there is an equal and opposite reaction force is Newton's 3rd Law.
21. The law that states that the unbalanced force acting on an object equals the object's mass times its acceleration is Newton's 2nd Law.
22. What is the SI unit for force? Newton (N)
23. When the force of air resistance balances the force of gravity of an object that is falling, velocity (increases, **stays the same,** decreases)? Why? When forces are balanced there is NO change in motion (if it's moving it will continue to move b/c of Newton's 1st Law).

Mixed Review Calculations [show your GIVEN, EQUATION, and SOLVE]

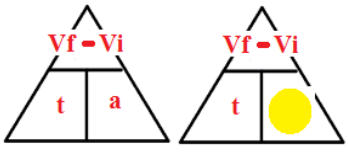
24. What is the velocity of a missile that travels north 8000 meters in 10.12 seconds?

Given	Equation	Solve
v = ??? d = 8000 m t = 10.12 s		$v = \frac{8000 m}{10.12\ s} = 790.5 \frac{m}{s}$

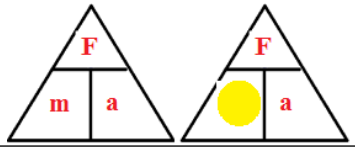
25. What distance does a rocket flying for 5 seconds at 100 m/s travel?

Given	Equation	Solve
s = 100 m/s d = ??? t = 5 s		$d = 5s \times 100 \frac{m}{s} = 500\ m$

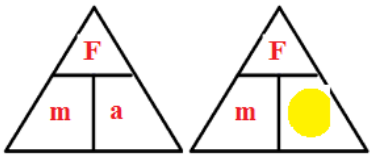
26. In 5 seconds, a car goes from 0 m/s to 60 m/s. What is the acceleration of the car?

Given	Equation	Solve
a = ??? v_f = 60 m/s v_i = 0 m/s t = 5 s		$a = \frac{60 \frac{m}{s} - 0 \frac{m}{s}}{5\ s} = 12 \frac{m}{s^2}$

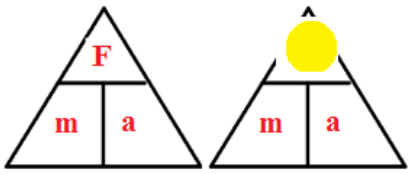
27. A car's engine produces a force of 1500 N and it accelerates at 2.5 m/s^2. What is its mass?

Given	Equation	Solve
F = 1500 N m = ??? a = 2.5 m/s^2		$m = \frac{1500\ N}{2.5\ {}^{m}/_{s^2}} = 600\ kg$

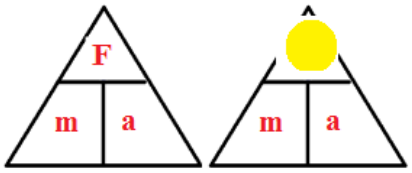
28. You throw a 0.5 kg ball with a force of 15 N. What is the ball's acceleration?

Given	Equation	Solve
F = 15 N m = 0.5 kg a = ???		$a = \frac{15\ N}{0.5\ kg} = 30\frac{m}{s^2}$

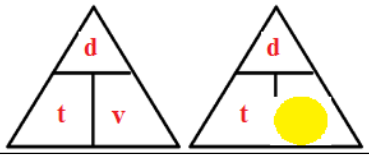
29. A 15 kg ball accelerates at 20 m/s^2 what force was exerted on the ball?

Given	Equation	Solve
F = ??? m = 15 kg a = 20 m/s^2		$F = 15\ kg\ \times 20\ \frac{m}{s^2} = 300\ N$

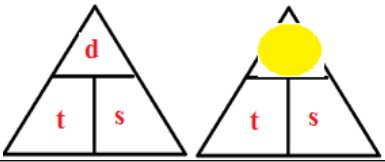
30. How much force is required to accelerate a 2 kg rock at 3 m/s^2?

Given	Equation	Solve
F = ??? m = 2 kg a = 3 m/s^2		$F = 2\ kg\ \times 3\frac{\mathrm{m}}{s^2} =\ 6N$

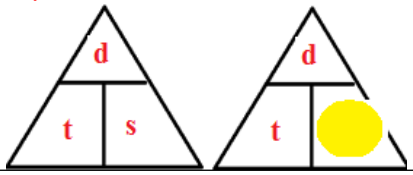
31. A horse ran 500 meters down the hill in 50 seconds. What is the velocity of the horse?

Given	Equation	Solve
v = ??? d = 500 m t = 50 s		$v = \frac{500m}{50s} = 10\frac{m}{s}$

32. Sally drove at a speed of 50 km/hr. south for 2 hours. How far did she travel?

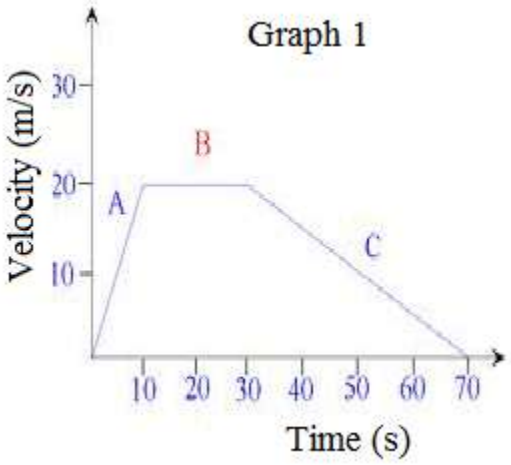
Given	Equation	Solve
s = 50 km/hr d = ??? t = 2 hours		$d = 50\frac{km}{hr} \times 2\ hr = 100\ km$

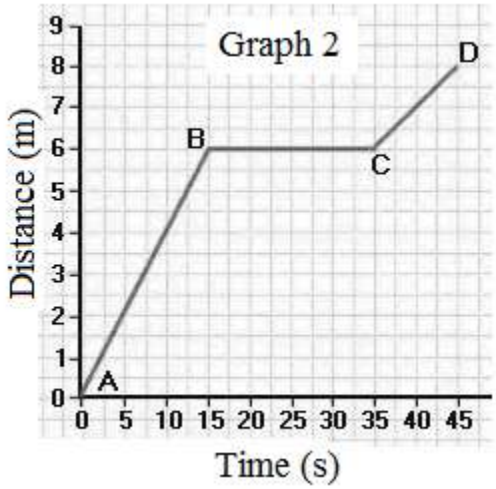
33. A hiker walked a 5 kilometer trail in 65 minutes. What was his speed?

Given	Equation	Solve
s = ??? d = 5 km t = 65 min		$s = \frac{5\ km}{65\ min} = 0.0769\frac{km}{min}$

Graphing Motion

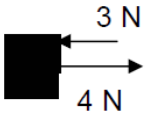
34. A horizontal line on a distance-time graph means the object is not moving (at rest).
35. An upward slope on a distance-time graph means the object is moving forward/speeding up.
36. A downward slope on a distance-time graph means the object is moving backwards/slowing down.
37. A horizontal line on a speed-time graph shows that an object is not accelerating (no change in motion)
38. On a speed-time graph, a line with a negative slope indicates that the object is slowing down (decelerating).
39. On a speed-time graph, a line with a positive slope indicates that the object is speeding up (accelerating).



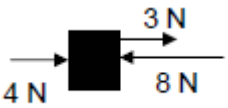


40. On Graph 1 calculate the following (**SHOW YOUR WORK with UNITS)**
    a. Acceleration from 0 to10 seconds. $a = \frac{20\frac{m}{s} - 0\frac{m}{s}}{10\ s} = 2\ m/s^2$
    b. Acceleration from 10 to 30 seconds $a = \frac{20\frac{m}{s} - 20\frac{m}{s}}{20\ s} = 0\ m/s^2$
    c. Acceleration from 30 to 70 seconds $a = \frac{0\frac{m}{s} - 20\frac{m}{s}}{40\ s} = -0.5\ m/s^2$
41. On Graph 2 calculate the following (**SHOW YOUR WORK with UNITS)**
    a. Find the average speed. $s = \frac{8m - 0m}{45s - 0s} = 0.178\frac{m}{s}$
    b. Find the speed from 0 to 15 seconds $s = \frac{6m - 0m}{15s - 0s} = 0.4\frac{m}{s}$
    c. Find the speed from 15 to 35 seconds. $s = \frac{6m - 6m}{35s - 15s} = 0\frac{m}{s}$

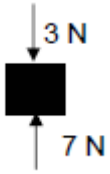
Net Forces Find the net force acting on the following items. Be sure to include direction.

42. 

[4N-3N] = 1 N Right

43. 

4N+3N-8N= -1N Left Or 1N Left

44. 

[7N-3N]= 4N Up
[3N +3N] = 6N Right

45.