NAME _____ DATE _____ PERIOD _____

Physics Test Review

Formulas to MEMORIZE:

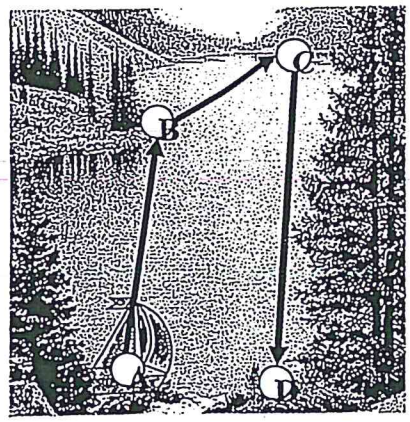
$S = D/T$	Speed = Distance divided by Time Average Speed = Total Distance divided by Total Time
$V = \Delta X/T$	Velocity = change in position divided by time
$A = (V_2 - V_1) / T$	Acceleration = (final velocity minus initial velocity) divided by time
$F = ma$	Force = mass times acceleration
$KE = 1/2\ m\ v^2$	Mass is in kg, Velocity is in meters/second, KE is in Joules
$PE = mgh$	g is the acceleration due to gravity (9.8 m/s^2), Height is in meters, PE is in Joules
$Work = Fd$	Work is in Joules, Force is in Newtons, distance is in meters

Speed and Velocity

1. What is the average speed of car that travels 50 miles in 2 hours, then stops for 1 hour then travels 200 miles in 3 hours? $S = \frac{d}{\Delta t} = \frac{50\ mi + 200\ mi}{2hr + 1hr + 3hr} = \frac{250\ mi}{6\ hr} =$ **41.6 mi/hr**

2. What is the average speed of a dog that chases a cat for 31 meters in 20 seconds and 14 meters in 12 seconds? $S = \frac{d}{\Delta t} = \frac{31 + 14\ m}{20 + 12\ s} = \frac{45\ m}{32\ s} =$ **1.4 m/s**

3. A boat traveled from A to B to C and finished at D. The trip took 6 minutes. The distances are listed below:
   - **A-B:** 235 meters
   - **B-C:** 23 meters
   - **C-D:** 325 meters
   - **A-D:** 30 meters



   What is the boat's average velocity?

   how solved: $V = \frac{\Delta X}{\Delta t} = \frac{30\ m}{6\ min} =$ **5 m/min**

4. What would your average velocity be if you walked for 20 seconds around the classroom, walking a total distanc 40 feet and ending up sitting two feet South of where you started? $V = \frac{\Delta X}{\Delta t} = \frac{2\ ft}{20\ sec} =$ **0.1 ft/s**

5. Create a scenario where the velocity is 0:
   You either don't move or end up in same position as you start.

6. a. How are speed and velocity the same?
   Both are a rate and tell a distance per time

   b. How are speed and velocity different?
   velocity includes direction and speed does not.

NAME _____ DATE _____ PERIOD ____

Acceleration

7. A dog was walking along at 1 meter/second when he saw a cat. In 2 seconds, the dog was sprinting along at 4 meters/second. What is the acceleration of the dog?

$a = \frac{\Delta v}{\Delta t} = \frac{4\,m/s - 1\,m/s}{2\,s} = \frac{3\,m/s}{2\,s} = \boxed{1.5\,m/s^2}$

8. If an object is accelerating, it can be doing one of three things:
   a. Speeding up
   b. Slowing down
   c. Changing direction

   Can an accelerating object stay at the same speed? Explain.

   Yes, if the object is changing direction.

9. What does it mean if a car is accelerating at 10 m/s^2?

   Every second the car will be going 10 m/s faster.

10. According the hot wheels data table, what is the acceleration of the car?

Time (seconds)	Velocity (m/s)
0	0
1	18
2	40
3	85
4	115
5	150

$a = \frac{\Delta v}{\Delta t} = \frac{150\,m/s - 0\,m/s}{5\,sec}$

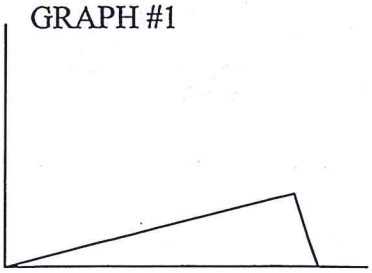
$= \frac{150\,m/s}{5\,s} = \boxed{30\,m/s^2}$

Graphing

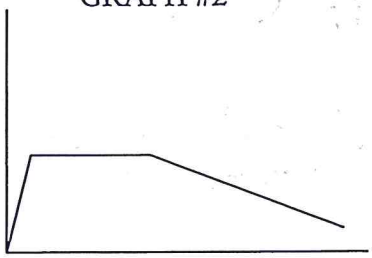
11. When does a position time graph have a curve?

    When acceleration is happening.

GRAPH #1



GRAPH #2



12. Describe the motion of the above are position-time graphs.

    Graph #1 Going in positive direction at a constant speed, then going in the other direction at a faster constant speed.

    Graph #2 Going in a positive direction at a fast constant speed, stopping, then going in opposite direction at a slower constant speed.

13. Describe the motion if the above are velocity-time graphs.

    Graph #1

    Speeding up slowly, slowing to a stop quickly.

    Graph #2

    Speeding up quickly, going at a constant speed, slowing down

NAME _____ DATE _____ PERIOD _____

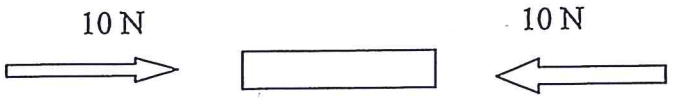
Newton's Laws/Forces

14. State Newton's Laws:
    a. Newton's 1st law: Balanced forces = constant speed
    b. Newton's 2nd law: Unbalanced forces = acceleration
    c. Newton's 3rd law: force pairs: A pushes on B with same force B pushes on A.

15. What is inertia? What does it have to do with pushing a heavy kitchen table?

Inertia is the tendancy for something to not change its motion. An object with more mass has more inertia.

16. Is the following object moving? Why or why not?

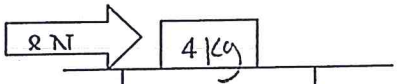


Maybe, forces are balanced so speed is constant but it could be a constant speed of 0 m/s or 20 m/s,

17. Without friction, a constant force acting on an object causes the object to move with constant:
    A. speed. B. acceleration. C. leverage. D. resistance.

$F_{Net} = m \cdot a$

18. The diagram below shows a 8.0 newton force applied to a 4.0 kg block on a frictionless table. What is the block's acceleration?



$F_{Net} = m \cdot a$ $\quad 8N = (4kg)(a)$ $\quad a = \frac{8N}{4kg} = \boxed{2\ m/s^2}$

19. A force of 10 N accelerates an object at 5.0 m/s^2. What force would be required to accelerate the same object at 1.0 m/s^2?

Situation A: $F = m \cdot a$ $\quad 10N = (m)(5\ m/s^2)$ $\quad m = \frac{10N}{5\ m/s^2} = \boxed{2kg}$

Situation B: $F = m \cdot a$ $\quad F = (2kg)(1\ m/s^2)$ $\quad \boxed{F = 2N}$

20. If the mass of a tennis ball is 0.3kg and you want it to accelerate at a rate of 7m/s^2 with how much force do you need to hit it?

$F_{Net} = m \cdot a$

$F = (.3kg)(7\ m/s^2) = \boxed{2.1\ N}$

21. A bulldozer exerts a 2,000N force on a wall. Describe the force the wall exerts on the bulldozer.

wall pushes with same force on bulldozer of 2000 N

22. Explain why a big fire hose has long handles on the side of it.

Because the water comes out of the hose with a large force; Newtons 3rd law says force on hose by water is equal to force on water by hose. Easier to hold hose with large force if large handles.

NAME _____ DATE _____ PERIOD ____

23. If an object is already moving…
   a. What will happen to the object if the forces are balanced?
   motion stays the same (constant speed)
   b. What will happen to the object if the forces are unbalance?
   acceleration (speed up, slow down, change directions)

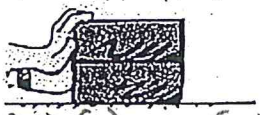
True or False:

24. If the force of one hand accelerates a brick, then

accelerates the brick

$F = m \cdot a$

Twice the force on twice the mass gives the same acceleration



$(F)(2) = (m)(2) \cdot a$

True

25. Describe how different objects fall if dropped at the same time, and describe why they do this.
   Mass does not affect time for an object to fall. From the same height, objects will go the same speed (if no friction)

Forces

26. Describe types of forces in a variety of situations.
   (various answers)

Work

27. Compute the weight of these 5 items (in N)
   a. bottle of juice (1.8 kg) weight = mass · gravity
   weight = $(1.8\text{ kg})(10\text{ m/s}^2) = 18\text{ N}$
   b. full garbage can (66 kg)
   weight = $(66\text{ kg})(10\text{ m/s}^2) = 660\text{ N}$
   c. can of peaches (475 g)
   weight = $(475\text{ g})\left(\frac{1\text{ kg}}{1000\text{ g}}\right)(10\text{ m/s}^2) = 4.75\text{ N}$

28. How much work is done when 5 N of force is applied to a box moved:
   a. 2 meters work = Force x distance = $5\text{ N} \times 2\text{ m} = 10\text{ J}$
   b. 5 meters work = $F \cdot d = 5\text{ N} \cdot 5\text{ m} = 25\text{ J}$

29. You need to put several items in the top shelf of your closet. The shelf is 3.7 meters high. How much work is required to lift each of the following items up to the shelf?
   a. tennis racket (1.3 kg)
   work = Force x distance = $(1.3\text{ kg})(10\text{ m/s}^2)(3.7\text{ m}) = 48.1\text{ J}$
   b. suitcase (5.8 kg)
   work = Force x distance = $(5.8\text{ kg})(10\text{ m/s}^2)(3.7\text{ m}) = 214.6\text{ J}$
   c. box of old elementary school artwork (3.2 kg)
   work = $F \cdot d$ = $(3.2\text{ kg})(10\text{ m/s}^2)(3.7\text{ m}) = 118.4\text{ J}$

NAME _____ DATE _____ PERIOD _____

Name: _____ Date: _____ Period: _____

Physics Test Review Sheet

1) Michelle was learning about forces in her science class today. On the car ride home from school, she started thinking about the forces acting on the car. She wondered in what situations the car would have balanced forces on it.
Choose the answer below that you agree with the most.

(a) The car would have to be slowing down.
(b) The car would have to be moving at a constant speed
(c) The car would have to be at rest.
(d) The car could be going at any constant speed, including being at rest.

2) If a car is moving at a high constant speed, which of the following statements is true?

(a) The forces are balanced
(b) There is a large, unbalanced force in the direction of motion
(c) The force of motion is keeping the car moving

3) If the forces on the car are balanced, then it is safe to say that the car is:

(a) Not moving at all
(b) Accelerating
(c) Moving at a steady speed
(d) Either at rest or moving at a steady speed

4) At hockey practice, Michelle hit a puck across the ice. After it is no longer touching the stick, the puck continues to move because...

(a) No force is needed for the puck to keep moving at a constant speed
(b) The force from the stick continues to push the puck forward, but it eventually runs out
(c) There is a force of motion that keeps the puck going

5) Herb then investigates different factors that might affect how fast the box can go. Herb puts two different boxes on an air hockey table so that they are free to move without friction. Box 1 has twice the mass of box 2. He then pushes each of the boxes for 2 seconds with two different sized forces as shown in the diagrams below.

NAME _____ DATE _____ PERIOD ____

In which situation(s) do you think the box moved the fastest at the end of Herb's 2 second long push? (which accelerates more)

A Box 1 →

B Box 1 →

C Box 2 →

D Box 2 →

(a) A
(b) B
(c) C
(d) D
(e) A and C
(f) B and
(g) All had same speed

$F=m \cdot a$
larger force with smaller mass has more acceleration

6) Ingrid takes two same-sized metal pucks to the local ice arena. One puck is made of steel and has a mass of 3 kg. The other puck is made of aluminum and has a mass of 1 kg. She gives both pucks the same size push for 2 seconds.

Compare the motion of the two pucks during the push.
(a) The steel puck speeds up faster.
(b) The aluminum puck speeds up faster.
(c) Both pucks speed up at the same rate.

$F=m \cdot a$
(mass of aluminum is less.)

8) After the steel puck slides across the ice for several seconds, it gradually slows down and stops. Why does the puck slow down and stop?

(a) The force on the puck gets smaller and smaller.
(b) No force is needed; moving objects tend to slow down.
(c) The puck is moving one direction and friction is pushing in the opposite direction.

9) Ingrid drops the 3-kg steel puck and the 1-kg aluminum puck at the same time from the same height. Ingrid observes that the pucks land at the same time.

How does the force on the steel puck compare to the force on the aluminum puck?

(a) The force is the same on both pucks since gravity made the two pucks fall at the same rate.
(b) The force on the steel puck must be 3 times as big since the steel puck had three times the mass.
(c) The force on the aluminum puck must be 3 times as big since the steel puck had three times the mass.

NAME _____ DATE _____ PERIOD _____

10) Imagine that the steel and aluminum pucks are taken far out into space away from planets and stars. Each puck is pushed with the same amount of force for the same amount of time.

How will the motions of the pucks compare?

(a) The steel puck will have the greater speed.
(b) The aluminum puck will have the greater speed.
(c) Both pucks will have the same speed.

11) After the pucks are pushed in space, which puck will stop moving first?

(a) The steel puck
(b) The aluminum puck
(c) Neither - Inertia keeps both pucks moving at constant speed unless there is an unbalanced force.

22) If you have a motor that exerts a constant force of 5N on a toy car, what will happen to the motion of the toy car?

(a) The toy car will accelerate
(b) The toy car will go straight
(c) The toy car will slow down
(d) The toy car will have a constant speed

28) A 12 kg bowling ball would require what fore to accelerate it down an alleyway at a rate of 3 m/s/s?

$F = m \cdot a$

$F = (12\,kg)(3\,m/s^2)$

$F = 36\,N$

29) What is the acceleration of 0.4 kg water balloon that hits Joe with a force of 15 N?

$F = m \cdot a$

$15\,N = (0.4\,kg)(a)$

$\frac{15\,N}{0.4\,kg} = a$

$a = 37.5\,m/s^2$

NAME _____ DATE _____ PERIOD ____

23) You drop a 5 kg rock off the top of a 1000m cliff.
(Show all calculations and include proper units on all answers.)

a) What is the potential energy of the rock when it is dropped?

$PE = m \cdot g \cdot h$

$PE = (5\,kg)(10\,m/s^2)(1000\,m)$

$\boxed{PE = 50{,}000\,J}$

b) What is the weight of the rock?

$\text{weight} = m \cdot g = (5\,kg)(10\,m/s^2) = \boxed{50\,N}$

c) What is the potential energy 150 meters from the ground?

$PE = m \cdot g \cdot h$

$PE = (5\,kg)(10\,m/s^2)(150\,m)$

$\boxed{PE = 7500\,J}$

d) What is the kinetic energy 150 meters from the ground?

$\text{Total Energy} = PE + KE$

$50{,}000\,J = 7500\,J + KE$

$KE = 50{,}000\,J - 7500\,J = \boxed{42{,}500\,J}$

e) What is the velocity 150 meters from the ground?

$KE = \frac{1}{2} m v^2$

$\frac{42{,}500\,J}{(\frac{1}{2})(5)} = \frac{(\frac{1}{2})(5\,kg)\,v^2}{(\frac{1}{2})(5)}$

$v^2 = 17{,}000\,m^2/s^2$

$\sqrt{v^2} = \sqrt{17{,}000\,m^2/s^2}$

$\boxed{v = 130.4\,m/s}$

NAME _____ DATE _____ PERIOD _____

Speed, Acceleration, Kinetic Energy, Potential Energy Review Sheet

1) With what force will a car hit a tree if the car's mass is 3000 kg and it is accelerating at a rate of 2 m/s/s?

$F = m \cdot a$

$F = (3000\,kg)(2\,m/s^2) = \boxed{6000\ N}$

2) What is the mass of a tuck that is accelerating at a rate of 5 m/s/s and hits a parked car with a force of 14,000 Newtons?

$F = m \cdot a$

$14{,}000\ N = (m)(5\,m/s^2)$

$m = \frac{14000}{5} = \boxed{2{,}800\ kg}$

3) What if the acceleration of a softball if it has a mass of 0.5 kg and hits the catchers' glove with a force of 254 Newtons?

$a = \frac{\Delta v}{\Delta t}$ $\quad F = m \cdot a$

$254\ N = (.5\,kg)(a)$

$a = \frac{254}{.5} = \boxed{508\ m/s^2}$

4) You drop a water balloon from the Golden Gate Bridge (67 meters off above the Pacific Ocean). The water balloon has a mass of 3 kg. Fill in the chart. **Show your calculations!**

	Total Energy	Potential Energy	Kinetic Energy	Velocity (meters/second)	Position
	PE+KE	$m \cdot g \cdot h$	$\frac{1}{2}mv^2$		
A	2010J	$(3kg)(10\,m/s^2)(67m)$ $= \boxed{2010J}$	$(\frac{1}{2})(3)(0)^2$ $\boxed{0J}$ (Not moving)	0 m/s (Not moving)	Before Dropping (67 m)
B	2010J	Total = PE+KE 2010 = 600+PE $\boxed{1410J}$	$\frac{1}{2}mv^2$ $(\frac{1}{2})(3)(20)^2$ $= \boxed{600J}$	20 m/s	Falling
C	2010J	$m \cdot g \cdot h$ $(3)(10)(0)$ $\boxed{0J}$ (NOT above ground)	Total = PE+KE 2010 = 0 + KE $\boxed{2010J}$	$KE = \frac{1}{2}mv^2$ $2010 = (\frac{1}{2})(3)(v^2)$ $\sqrt{v^2} = \sqrt{1340}$ $\boxed{v = 36.6\ m/s}$	Hits Ocean