

Name _____

Math Review and Significant Figures**Please circle the best answer**

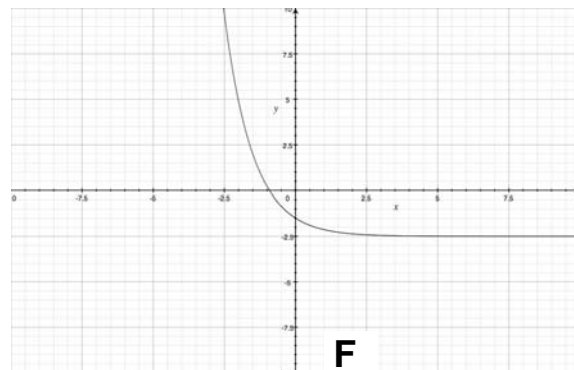
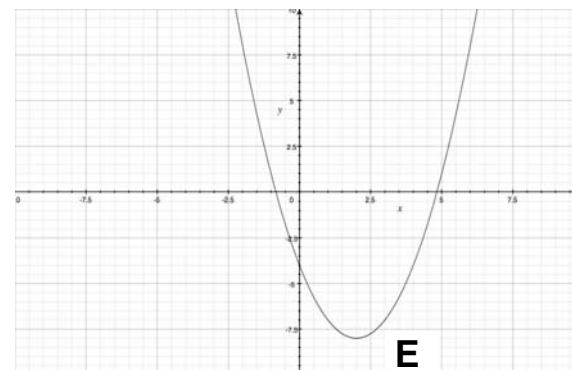
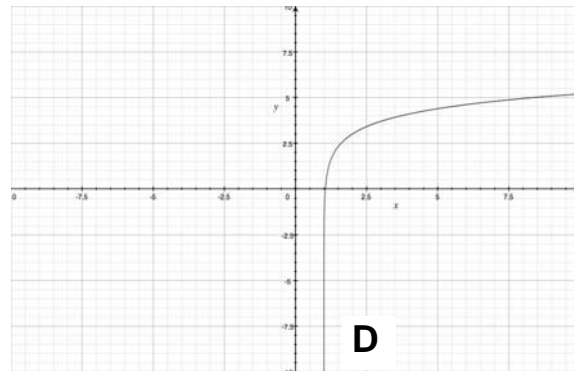
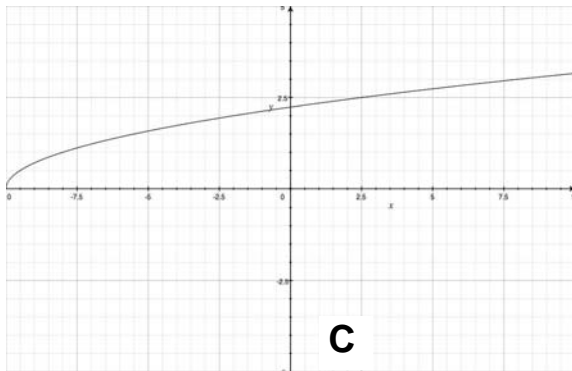
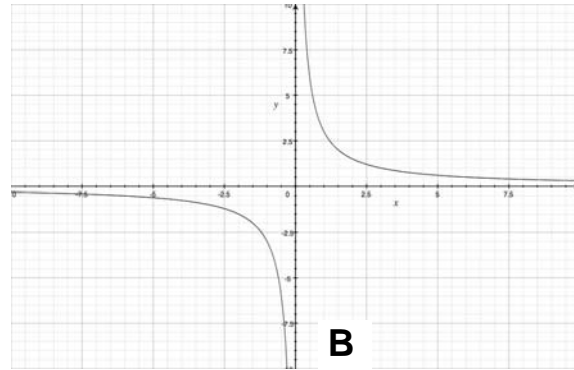
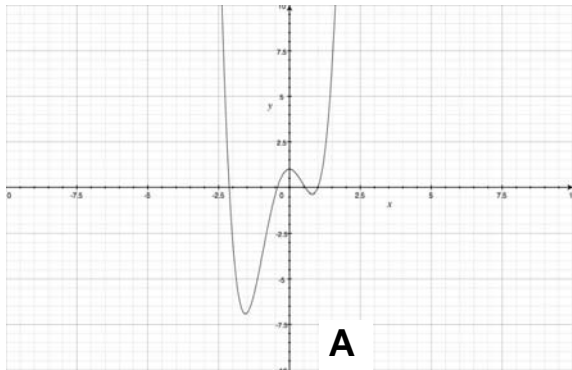
1. What would be the approximate dollar value of a straight trail of pennies from the Borough of Manhattan in New York to Pasadena City College in California, where each penny is horizontal and tangent to the previous penny in the trail?
A. \$200,000
B. \$2,000,000
C. \$20,000,000
D. \$200,000,000
E. 2,000,000,000
2. The approximate average number of seconds in the average life span is
A. 2^{30} B. 2^{31} C. 2^{32} D. 2^{33} E. 2^{34}
3. If $(4900)^4 = (7.0)^x (10)^y$ what are x and y?
A. $x=8$ and $y=12$
B. $x=4$ and $y=4$
C. $x=4$ and $y=6$
D. $x=2$ and $y=24$
4. What is $(3.50 \times 10^{27})(4.50 \times 10^{86})$?
A. too large to calculate
B. 1.58×10^{114}
C. 8.00×10^{2322}
D. 4.50×10^{86}
5. What is $10^{15} + 10^3$?
A. 10^5 B. 10^{12} C. 10^{18} D. 10^{45}
E. None of the above
6. The density of planet A and planet B are the same. Both planets are spherical. If the radius of planet B is twice that of planet A, then the mass of planet B is
A. one-fourth that of planet A.
B. one-eighth that of planet A
C. four times that of planet A
D. eight times that of planet A
7. The density of planet A and planet B are the same. Both planets are spherical. If the mass of planet B is one fourth that of planet A, then the ratio the radius of planet B to planet A is
A. $4^{-1/3}$ B. $1/4$ C. $4^{-1/2}$ D. 16 E. 64

Physics A

8. If the planets in the previous question were cubes instead of spheres, then answer the ratio the radius of planet B to planet A would be
- A. $4^{-1/3}$
 - B. $1/4$
 - C. $4^{-1/2}$
 - D. 16
 - E. 64
9. and this is true because
- A. mass depends on square of surface area
 - B. mass depends on the cube of a length measurement
 - C. mass is inversely proportional to volume
 - D. mass is constant
10. The ratio of surface areas between two cubes is 10. What is the ratio of the volume of the larger cube to the smaller cube?
- A. 10
 - B. $10^{1/2}$
 - C. $10^{3/2}$
 - D. $10^{1/3}$
11. Solve the equation $\frac{1}{4-x} + \frac{1}{3} = 1$ for the variable x without using a calculator.
- A. $x=-2$
 - B. $x=0$
 - C. $x=1.5$
 - D. $x=2.5$
 - E. $x=5$
12. Solve the equation $\frac{1}{4-x} + \frac{1}{x} = \frac{16}{7}$ for the variable x without using a calculator.
- A. $x=3$
 - B. $x=0.5$ or $x=3.5$
 - C. $x=1$
 - D. $x=0.75$ or $x=2.25$
 - E. no solution possible

Physics A

Consider the graphs of functions below and answer the following questions.



13. Which of the above graphs represents a plot of a square root function? _____
14. Which of the above graphs is representative of a fourth order polynomial? _____
15. Which of the above graphs is representative of a hyperbola? _____
16. Which of the above graphs is representative of a logarithmic function? _____
17. Which of the above graphs is representative of an exponential function? _____

Consider the following four calculations involving physical measurements and answer the following

$$\frac{3.1414m - 3.14159m}{3.14159s}$$

A

$$(37.4m / s)(9.34s) + 101.3m$$

B

$$37.345m / s + 1129.1m / s + 0.39451m / s$$

C

$$(2.54m)(11 / s)$$

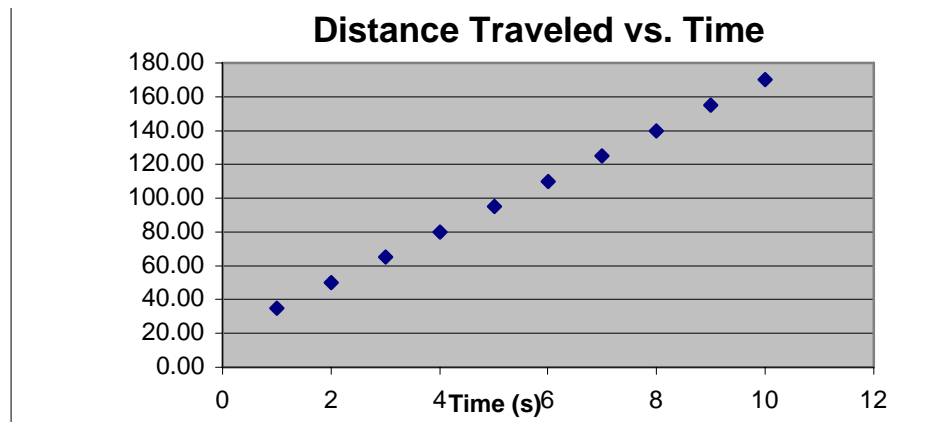
D

18. Which of the above calculations should be reported to 5 significant figures? _____
19. Which of the above calculations should be reported to 1 significant figure? _____
20. Which of the above calculations should be reported to 1 the tenth place? _____
21. Which of the above calculations should be reported to 3 significant figures? _____
22. Which of the above calculations should have units of m/s^2 ? _____

23. A cyclist rides for 170m in 10.0s. What was the average speed of the cyclist?
 A. 17.0m/s B. 30.0m/s C. 45.0m/s

24. A person tracks the position of a bicycle measures the distance traveled as a function of time. A table and graph of his data is shown below. an object travels as a function of time. The data and graph are shown below. Please answer the following questions.

seconds	cm
1.00	35.0
2.00	50.0
3.00	65.0
4.00	80.0
5.00	95.0
6.00	110.0
7.00	125.0
8.00	140.0
9.00	155.0
10.00	170.0



- Determine the average speed of the car?
- If we determined the slope of this graph what are the units of it? What physical quantity does the slope of the above graph represent? What is the slope of this graph?
- What is the y-intercept of this graph? What physical meaning the y-intercept have in this case?
- How does the slope obtained from part c compare to the correct answer in question 23?

Name _____

Conceptual Questions: Kinematics

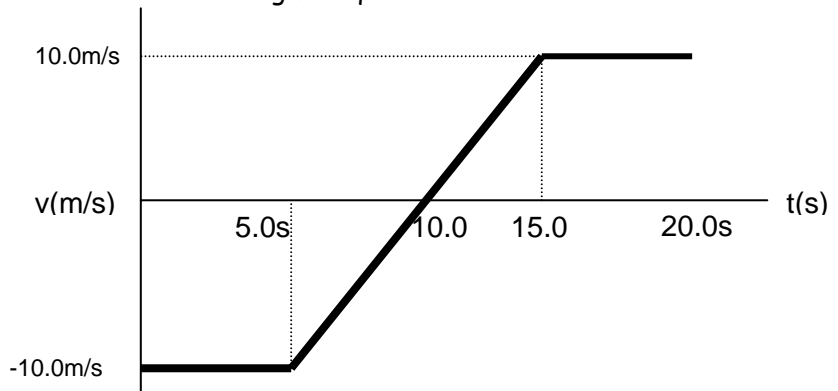
Please circle the best answer

- Your car can accelerate from 10 m/s to 30 m/s in 2 seconds. The acceleration of the car in g's is (use 10 m/s^2 for acceleration of gravity g)
 - 1
 - 2
 - 64
 - 32
- A ball is thrown straight upward. When it has reached the highest point in its motion, and is momentarily stopped, its acceleration is
 - 1 g up
 - 1 g down
 - zero
 - answer depends on weight of ball
- George drives from town A to town B and back to town A in 2 hours. The distance between town A and town B is 60 miles. What is the average velocity for the entire trip?
 - 0 mph
 - 30 mph
 - 60mph
 - 120mph
- Which one of the following is not a vector quantity?
 - acceleration
 - average speed
 - displacement
 - average velocity
 - instantaneous velocity
- An object moves with velocity in +x-direction with constant acceleration a . After 3 seconds, its acceleration changes to a constant value $-a$. Which of the following statements is true regarding the motion of the object upon this sudden change in acceleration?
 - Its velocity and displacement become negative.
 - Its velocity is positive but its displacement is negative.
 - Its position and velocity decrease.
 - Its position increases, but its velocity decreases.
 - Its position and velocity increase
- Which one of the following statements is an accurate statement about an object moving in one dimension?
 - If velocity and acceleration have opposite signs, the object is slowing down.
 - If position and velocity have opposite signs, the object is slowing down.
 - If an object is not moving, it must have zero acceleration at that instant.
 - It is not possible for an object to have both negative velocity and negative acceleration.
- Which one of the following situations is impossible?
 - An object has velocity directed east and acceleration directed east.
 - An object has zero velocity but non-zero acceleration.
 - An object has constant acceleration and changing velocity.
 - An object has constant velocity and changing acceleration.
 - An object has velocity directed east and acceleration directed west

Physics A

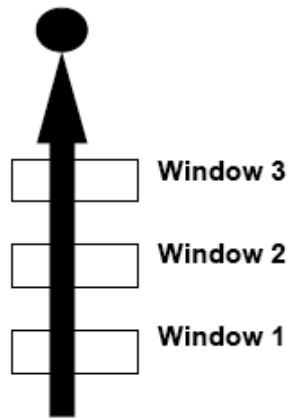
8. If an object moves at constant velocity, which of the following increases with time?
- average velocity
 - instantaneous velocity
 - displacement
 - direction
 - acceleration

A physics student measured the velocity of an object as a function of time. A graph of the data is shown below. Please use this graph to answer the following five questions.



9. What is the velocity of the object at $t=10.0s$?
- 0m/s
 - 10m/s
 - 10m/s
10. What is the acceleration of the object between 5.0 and 10.0s?
- 0m/s
 - 1m/s
 - $2m/s^2$
 - $10.0m/s^2$
 - $-10.0m/s^2$
11. When is the acceleration zero (there may be more than one correct answer).
- Between 0 and 5.0s
 - Between 5.0s and 10.0s
 - At 10.0s
 - Between 10.0s and 15.0s
 - Between 15.0 and 20.0s
12. What is the displacement of the object between 5.0 and 10.0s?
- 0m/s
 - 25.0m
 - 50.0m
 - 25.0m
 - 50.0m
13. What is the displacement of the object between 5.0 and 15.0s?
- 0m/s
 - 25.0m
 - 50.0m
 - 25.0m
 - 50.0m
14. What is the displacement of the object between 10.0s and 17.5s?
- 0m/s
 - 25.0m
 - 50.0m
 - 25.0m
 - 50.0m
15. An object is thrown straight up with an initial velocity of $9.8m/s$. Which of the following is true regarding the velocity and acceleration of the object when it reaches its maximum height?
- $v=0$ and $a=0$
 - $v=9.8m/s$ upward and $a=9.8m/s^2$ downward
 - $v=0$ and $a=9.8m/s^2$ downward
 - $v=9.8m/s$ downward and $a=9.8m/s^2$ upward
 - $v=9.8m/s$ upward and $a=0$

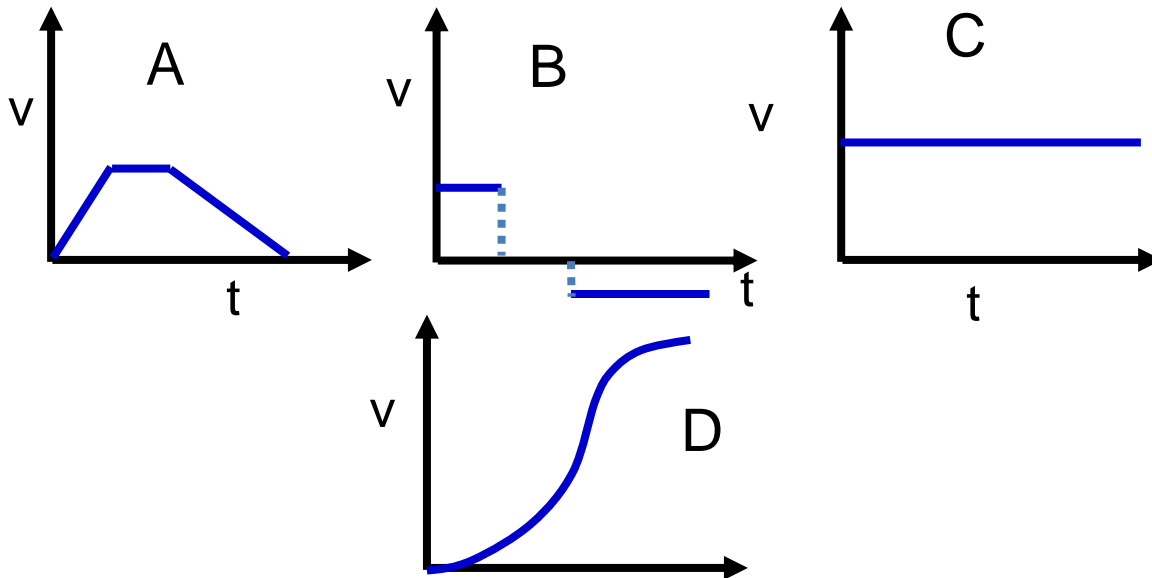
16. A ball is thrown straight up. It passes three windows that are identical in size. A student measures the average speed of the ball as it passes each window. In which case is the average speed of the ball greatest?
- As it passes window 1
 - As it passes window 2
 - As it passes window 3
 - The average speed is the same in all cases



17. Which one of the following physical quantities is not correctly paired with its dimension?

<i>Physical Quantity</i>	<i>Dimension</i>
A. Velocity	$[L]/[T]$
B. Total Distance Traveled	$[L]$
C. Speed	$[L]/[T]$
D. Displacement	$[L]/[T]$
E. Speed x Time	$[L]$

18. A car starting from rest speeds up to 30 m/s with a constant acceleration over a time of 10 seconds. Then, it travels at 30 m/s for 10 seconds, and finally brakes to a stop in 20 seconds with a constant deceleration. Which of the following graphs represents its graph of speed versus time?



19. A car starting from rest speeds up to 30 m/s with a constant acceleration over a time of 10 seconds. Then, it travels at 30 m/s for 10 seconds, and finally brakes to a stop in 20 seconds with a constant deceleration. How far does it travel in the 40 second time period?
- 100 m
 - 250 m
 - 400 m
 - 750 m

Name _____

Conceptual Questions: Vectors

Please circle the best answer

1. Can a vector **A** have a component greater than its magnitude A ?
A. Always B. Sometimes C. Never
2. The component of the x-component of a vector is 40 units west and the y-component is 30 units north. Which of the following correctly describes the direction of the vector?
A. 53 degrees counterclockwise from the positive x-axis
B. 37 degrees clockwise from the positive x-axis
C. 143 degrees counterclockwise from the positive x-axis
D. 137 degrees clockwise from the positive x-axis
3. The magnitude of one vector is 5 units and that of the other is 12 units. If these two vectors are they are perpendicular to each and added, then the resultant vector is
A. 7 units B. 13 units C. 19 units D. 109 units E. 169 units
4. The magnitudes of two vectors **A** and **B** are $A = 12$ units and $B = 8$ units. The largest and smallest possible values for the magnitude of the resultant vector $\mathbf{R} = \mathbf{A} + \mathbf{B}$ are
A. 14 and 4 B. 12 and 8 C. 20 and 4 D. none of these answers.
5. If vector **B** is added to vector **A** (its magnitude different than **B**), the resultant vector $\mathbf{A} + \mathbf{B}$ has magnitude $A + B$ when **A** and **B** are
A. perpendicular to each other
B. oriented in the same direction
C. oriented in opposite directions
D. in any direction relative to each other.
6. If vector **B** is added to vector **A** (its magnitude different than **B**), the resultant vector $\mathbf{A} + \mathbf{B}$ has magnitude 0 when **A** and **B** are
A. perpendicular to each other
B. oriented in the same direction
C. oriented in opposite directions
D. in any direction relative to each other
E. never
7. The negative of a vector **A**
A. is the negative of the magnitude of **A**
B. is in the opposite direction of **A** and has the same magnitude as **A**
C. doesn't exist

8. To subtract vector **B** from vector **A** one must
- A. add **A** to the negative of **B**
 - B. add **A** to **B** and flip its direction by 180 degrees
 - C. add the reciprocal of **A** to the reciprocal of **B**
 - D. add the x-components of **A** and **B** and subtract the y-components of **A** and **B**
9. The magnitude of one vector is 5 units and that of the other is 12 units. If these two vectors are perpendicular to each other and subtracted from each other then the resultant vector is
- A. 7 units B. 13 units C. 19 units D. 109 units E. 169 units
10. A vector is constant if its
- A. magnitude is constant
 - B. direction is constant
 - C. if its magnitude and direction are constant

Name _____

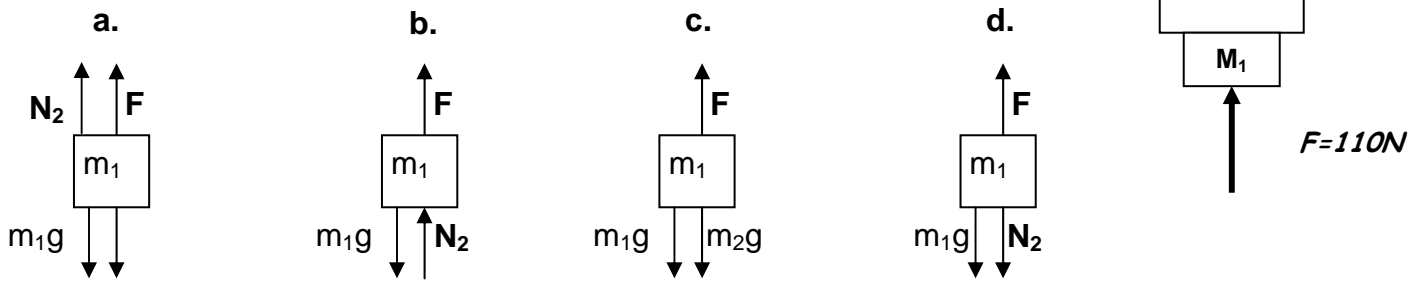
Conceptual Questions: Newton's Laws

Please circle the best answer

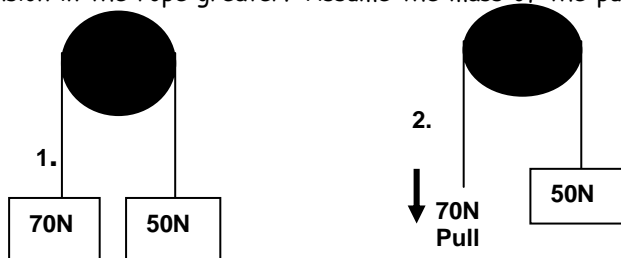
1. An object can have motion only if a net force acts on it. This statement is
a. True b. false
2. And the reason for this (refer to previous question) is due to
a. Newton's 1st law b. Newton's 2nd law c. Newton's 3rd law d. Newton's 4th law
e. Murphy's law
3. If an object is at rest, there can't be any forces acting on it. This statement is
a. true b. false
4. The direction of motion of an object will be in the direction of the largest force acting on the object. This statement is
a. true b. false
5. The normal force acting on an object is never greater than the weight of the object itself. This statement is
a. true b. false
6. An object moving in a circle at a constant speed has a net force acting on it. This statement is
a. true b. false
7. Tension in a string is the sum of the forces acting on both ends of the string. This statement is
a. true b. false
8. An object with a constant net force acting on it will have a constant
a. velocity b. acceleration c. position
9. The force of gravity causes objects such as a ball to fall toward the ground. Of course, the ball also exerts a force of gravity on the Earth. How do these forces compare?
a. the force on the ball is much greater than the force on the Sun
b. the force on the ball is much greater than the force on the Sun
c. they are the same for both
10. You are driving your car and a bug is splattered on your windshield. The greater force of impact will be on
a. the bug b. your windshield c. same force on both d. can't tell with information given
11. A train consisting of 35 railroad cars each weighing 98000 Newtons has acceleration of 1.0m/s^2 . The net force on the 24th car is
A. 350,000N B. 240,000N C. 110,000N D. 10,000N
12. Team A beat team B in a game of Tug-O-War. We therefore know that if the winning team pulled on the rope with a force of 10000 N, the losing team pulled on the rope with a force of
a. less than 10,000 N b. 10,000 N c. more than 10,000 N d. need more info

13. Also, we know that the ground pushed horizontally against the winning team with a force that is _____ compared to the force of ground against the losing team.
 a. greater b. same c. less d. need more info to answer
14. Can a horizontal force cancel a vertical force?
 a. never b. sometimes c. always
15. Your physics book weighs 40 N. If you drop it on the floor, the force of impact will be
 a. 40 N b. more than 40 N c. less than 40 N
16. What force causes you to move forward when you walk?
 a. The static frictional force of your foot on the sidewalk.
 b. The static frictional force of the sidewalk on your foot.
 c. The gravitational force of attraction between your feet and the sidewalk.

17. Consider the figure shown.
 Which of the following **best** represents the free body diagram for M_1 ?



18. You are standing on a scale in an elevator that is accelerating downward at a constant rate of $1.0m/s^2$. Your mass is 100kg. You look at the scale to determine your weight, it reads
 a. 101N b. 880N c. 980N d. 1080N
19. In which case shown below is the tension in the rope greater? Assume the mass of the pulley and the string are negligible.
 a. 1
 b. 2
 c. both are equal



20. A rope is tied to a tree. A student pulls on the rope. A second student decides to pull on the same side of the rope as the first student. If the second student pulls with the same force as the first student the tension in the rope
 a. Halved b. same c. doubled
21. Suppose that the rope in the above problem is untied and the students pull with equal but opposite forces F . As a result, the tension in the rope is
 a. 0 b. F c. $2F$ d. $4F$

Physics A

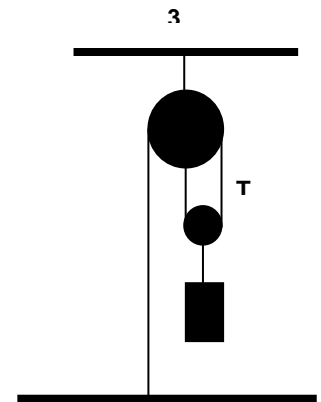
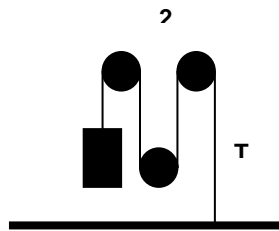
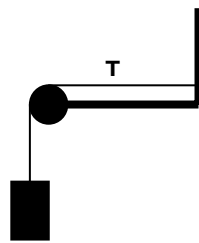
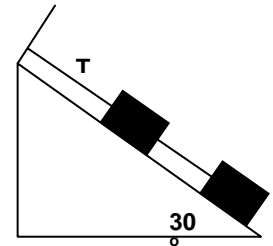
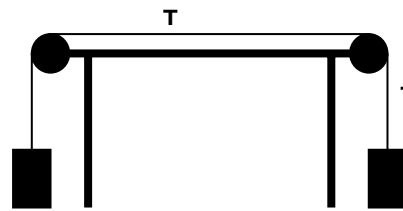
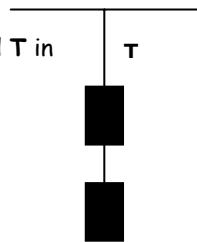
22. A car starts from rest and accelerates to the right. An stationary observer notices that the pair of dice hanging in the rearview mirror moves
- to the right because of the tension in the string that supports the dice
 - to the right because of the force producing the car's acceleration
 - to the left because of the force producing the car's acceleration
 - to the left because gravity
 - to the left because of the tension in the string that supports the dice
 - answer depends on the magnitude of the car's acceleration

The following six figures show various situations where blocks of the same mass m are supported by ropes either with pulleys or fixed objects. We are interested in the rope that is labeled T in each figure.

23. In which figure or figures is the tension T the greatest?

24. In which figure or figures is the tension T the least?

25. In which figure or figures is the tension $T=mg$?



4

5

6

Name _____

Conceptual Questions: Two Dimensional Motion

Please circle the best answer

1. A baseball is thrown horizontally from a cliff. At the same instant, a bowling ball is dropped from the same height. Assuming air resistance can be ignored, which of the following statements is correct?
 - A. The bowling ball hits the ground first.
 - B. Both the baseball and the bowling ball hit the ground at the same time.
 - C. The baseball has the greater acceleration just before it hits the ground.
 - D. The bowling ball has the greater velocity just before it hits the ground.
 - E. The bowling ball has the greater acceleration just before it hits the ground.
2. If air resistance can be neglected, what happens to the horizontal velocity component of a basketball as it is thrown to the basket from the free-throw line?
 - A. It increases.
 - B. It decreases.
 - C. It decreases until the ball reaches the top then increases as the ball comes down.
 - D. It increases until the ball reaches the top then decreases as the ball comes down.
 - E. It remains constant.

An object is launched with an initial speed of 30m/s at 60 degrees above the horizontal. Please answer the following four questions regarding this situation.

3. What will be its speed acceleration at its maximum height?
 - A. 15m/s and 0m/s^2
 - B. 30m/s and 0m/s^2
 - C. 15m/s and 9.8m/s^2 downward
 - D. 30m/s and 9.8m/s^2 downward
 - E. 0m/s and 0m/s^2
4. Assuming no air resistance the net force acting on the object is
 - A. zero
 - B. mg
 - C. greater than mg
 - D. less than mg
 - E. need more information
5. The direction of the acceleration vector
 - A. becomes horizontal when it is at its maximum height.
 - B. reverses direction when it reaches its maximum height.
 - C. never changes.

Physics A

6. If the initial vertical and final position of the object are the same, the time it takes to reach its maximum height is
 - A. is equal to the time it takes to come down.
 - B. is less than the time it takes to come down.
 - C. is greater than the time it takes to come down.

7. The direction of motion of a projectile is always determined from
 - A. the x and y components of the displacement vector.
 - B. the x and y components of the instantaneous velocity vector.
 - C. the x and y components of the instantaneous acceleration vector.
 - D. the initial launch angle of the projectile.

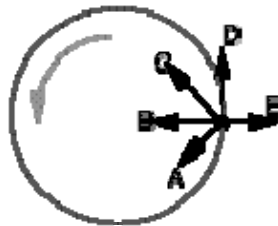
8. If you are carrying a ball and running at constant speed and wish to throw the ball so that you can catch it as it comes back down, should you
 - A. throw the ball at an angle of about 45° above the horizontal and maintain the same speed,
 - B. throw the ball straight in the air and slow down to catch it, or
 - C. throw the ball straight in the air and maintain the same speed?

9. As a projectile moves in its parabolic path, the velocity and acceleration vectors are perpendicular to each other
 - A. everywhere along its path
 - B. at the peak of its path
 - C. nowhere along its path
 - D. not enough information is given.

10. Your car moves in a circle at a *CONSTANT* speed of 50 m/s. The acceleration of your car is
 - A. 50 m/s^2
 - B. zero
 - C. need more info to determine acceleration

11. If the speed of an object is constant, its acceleration must be zero. This statement is
 - A. true
 - B. false

The figure below shows an object moving in circular motion. Please answer the following five questions.



12. Which of the arrows indicates the direction of the object at the instant shown?
 - A. A
 - B. B
 - C. C
 - D. D
 - E. E

13. Which of the arrows indicates the velocity of the object at the instant shown?
 - A. A
 - B. B
 - C. C
 - D. D
 - E. E

14. Which of the arrows indicates the acceleration of the object at the instant shown if its speed is constant?

- A. A B. B C. C D. D E. E

15. Which of the arrows indicates the net force on the object at the instant shown?

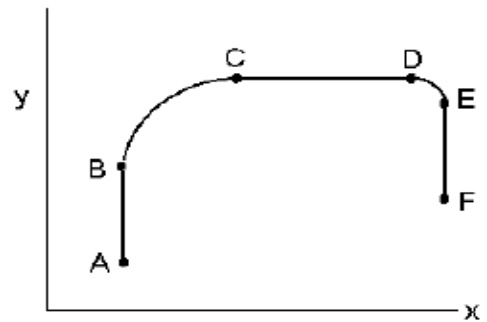
- A. A B. B C. C D. D E. E

16. Which of the arrows indicates the acceleration vector of the object if the object is slowing down at the instant shown?

- A. A B. B C. C D. D E. E

17. The figure below shows the path of a scooter on a flat horizontal surface. It starts at point A and moves at constant speed to point F. During which segment is the acceleration of the scooter greatest?

- A. AB
B. BC
C. CD
D. DE
E. EF



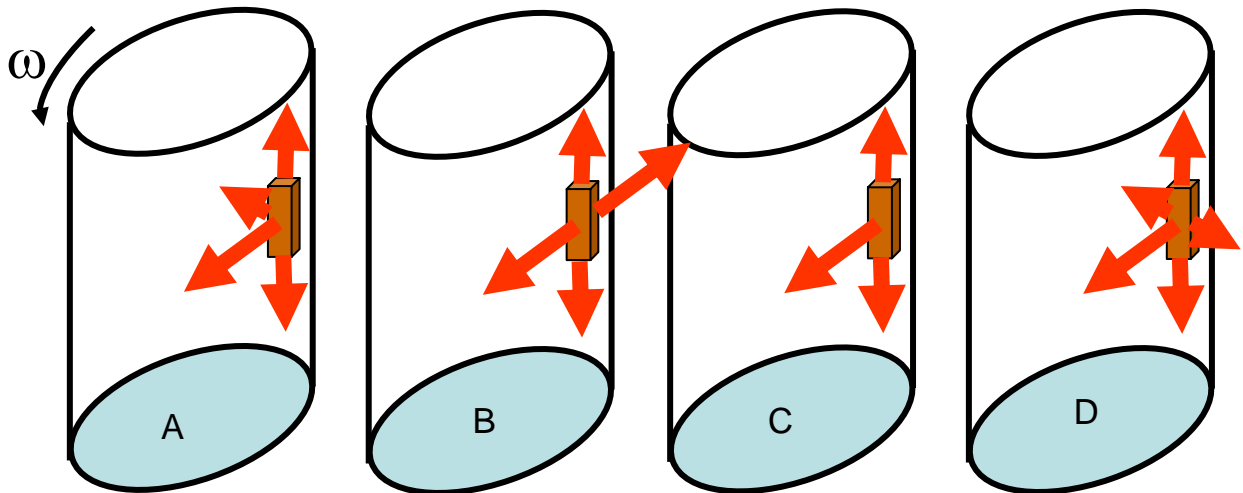
18. In uniform circular motion there is no tangential acceleration. This statement is

- A. True B. False

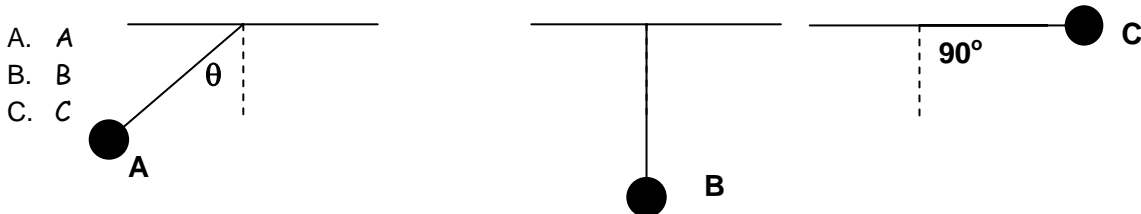
19. The radial component of an object undergoing circular motion has magnitude v^2/r only if the motion is with constant speed. This statement is

- A. True B. False

20. Bob the block is placed next to the cylindrical glass wall of an amusement park ride. The cylinder then begins spinning with a constant angular velocity, and spinning Bob remains stuck to the wall even when the floor drops away. The free-body diagram of all forces acting on Bob looks like:



21. If your car goes around a curve too quickly, you seem to be pushed against the door because of
- inertia
 - centrifugal force
 - friction
 - centripetal force
22. If an object moves at constant velocity, which of the following increases with time?
- average velocity
 - instantaneous velocity
 - distance traveled
 - direction
 - acceleration
23. Which of the following forces should not be included in a free-body diagram?
- friction
 - gravity
 - centripetal
 - normal
24. As you round a level curve in your car, you suddenly hit some ice. On the ice, your car will
- veer toward the center of the curve.
 - veer away from the center of the curve (in a direction that is opposite to choice A)
 - continue in the direction it had when it hit the ice.
25. A 100g mass is connected to a light string and suspended vertically. It is displaced through an angle and released. The diagrams below indicate the position of the mass at different times t . In which position is the tension in the string greatest?



26. A car goes over a bump in the road. The radius of curvature of the bump is R . Which of the following is true regarding the normal force acting on the car?
- The normal force acting on the car is independent of the speed of the car.
 - The normal force acting on the car increases as the speed of the car increases.
 - The normal force acting on the car decreases as the speed of the car increases.



27. Weight and mass are different physical quantities. This statement is
- true
 - false

28. You're on a diet. You step on a scale to determine your weight. As a result of the Earth's rotation, the value read off the scale is
- A. less than your true weight.
 - B. greater than your true weight.
 - C. is equal to your true weight only if you're at the equator.
 - D. is equal to your weight at the poles of the Earth.
 - E. A and D are true
 - F. B and C are true
 - G. B and D are true
29. The gravitational force on the Earth due to the Sun is
- A. less than the gravitational force on the Sun due to the Earth
 - B. equal than the gravitational force on the Sun due to the Earth
 - C. greater than the gravitational force on the Sun due to the Earth
30. If the radius of the Moon's orbit around the Earth were suddenly increased four-fold its orbital period would
- A. increase by two-fold
 - B. decrease by two-fold
 - C. increase by four-fold
 - D. increase by eight-fold
 - E. decrease by 64-fold.

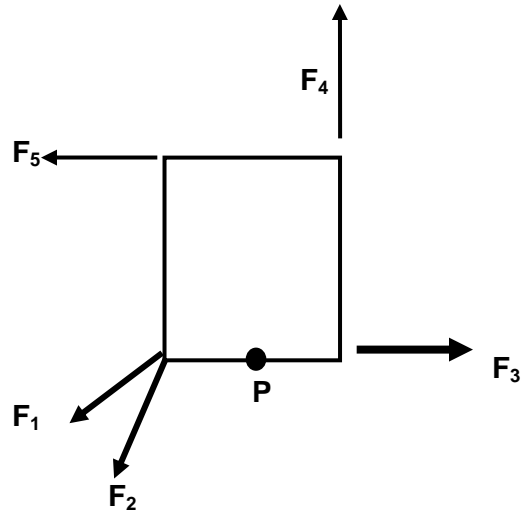
Name _____

Conceptual Questions: Rotational Motion and Torque

1. Define and explain the concept of torque.
2. What are the conditions for equilibrium?
3. Give examples where the sum of the forces equals zero, while the sum of the torques is non-zero. Give examples where the sum of the torques equals zero, while the sum of the forces is non-zero.
4. Stand up and touch your toes. Now with the back of your legs against a wall try touching your toes. Is the latter easier or harder? Explain using concepts discussed in class.
5. Suppose you are trying to loosen a nut with a wrench. You find that the nut won't budge. So you tie a rope to the end of the wrench. You then pull on the rope such that the angle between the wrench and the rope is 90 degrees. Does this help you? Is there a better way to remove the nut? Explain your answer using the concepts discussed in class.
6. The name of the quantity which is greater for a long 100 pound barbell than for a short 100 pound barbell, and makes the long barbell harder to twist is rotational
 - a. momentum
 - b. energy
 - c. inertia
 - d. weight
7. Why can't you open a door by pushing on its hinged side?
 - a. The lever arm is zero
 - b. The torque is zero
 - c. The work done on the door must be zero
 - d. both a and b are correct
 - e. both b and c are correct
8. Moment of inertia describes
 - a. The average position of the mass in an extended object.
 - b. How the mass of an extended object is distributed about a rotation axis.
 - c. How a force can rotate an object.
 - d. The tendency of an object to move in a straight line.
9. If a net force acting on a body produces purely linear motion
 - a. it must pass through body's center of mass
 - b. it must be zero
 - c. it must be less than the weight of the body
 - d. none of the above

10. Five forces of the same magnitude act on a square that can rotate about point P at the midpoint of one of the edges. Rank the forces (in *ascending* order) acting on it according to the magnitude of the torque they create about point P

- $F_2, F_3, F_4, \&F_5$ (tie), F_1
- F_3, F_4, F_1, F_2, F_5
- F_5, F_4, F_3, F_1, F_2
- F_3, F_1, F_2, F_4, F_5
- F_4, F_3, F_2, F_5, F_1



- A solid sphere and a hoop roll down an incline. The hoop is slower than the sphere if
 - mass of the hoop equals the mass of the solid sphere
 - radius of the hoop equals the radius of the solid sphere
 - both masses and radii are equal
 - the hoop is always slower regardless of their masses and radii.
- Suppose the objects in the problem above have the same mass and radius. Which object has more kinetic energy when it reaches the bottom of the incline?
 - The solid sphere
 - The ring
 - They both have the same kinetic energy
 - More information is needed.
- Suppose a solid sphere and a hoop are rolled up an incline plane with the same initial velocity. Which object will travel furthest up the plane?
 - The solid sphere
 - The hoop
 - The maximum heights up the incline plane will be the same since their initial velocities are the same!

14. Are the forces in the diagram below sufficient to keep the rod in equilibrium?

- Yes
- No
- Not enough information



15. Consider the following statement: An object is in equilibrium only if the sum of the forces acting on it is zero. This statement is

- True
- False

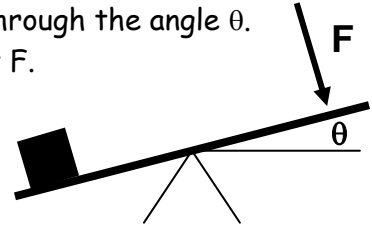
Conceptual Questions: Work, Energy, and Momentum

1. A rock sitting at the edge of a cliff contains energy called ----- energy.
a. potential b. kinetic c. chemical d. radiation e. electrical
2. If the rock falls off of the cliff, it gains energy called ----- energy.
a. potential b. kinetic c. chemical d. radiation e. electrical
3. Wanda claims that she has invented a machine that will allow a force of 100 N to be exerted, when the operator exerts only 2 N on the machine. This machine violates
a. conservation of energy b. conservation of momentum c. no physical law
4. Also, Wanda claims that she has invented a machine which continuously puts out 100 units of energy while consuming only 10 units of energy . This machine violates
a. Conservation of energy b. conservation of momentum c. no physical law
5. You push a block up a frictionless hill at constant speed. The work done by gravity when you push the block up the hill is equal to
a. ΔU b. $-\Delta U$ c. 0 d. none of the above
6. You push a block up a frictionless hill at constant speed. The work that you do in pushing the block up the hill is equal to
a. ΔU
b. $-\Delta U$
c. 0
d. none of the above
7. You push a block up a frictionless hill at constant speed. The total work done on the object when you push the block up the hill is equal to
a. ΔU
b. $-\Delta U$
c. 0
d. none of the above
8. The power you must deliver to the block in the above question
a. increases
b. decreases
c. remains constant
 as the distance traveled up the hill increases.

9. Why is the concept of work important?
- Because work describes the position of an object as a function of time.
 - Because the work done on an object is always independent of the path.
 - Because the work done on an object depends on its path.
 - Because work is a form of energy.
 - Because work provides a link between force and energy.
10. Two marbles, one twice as heavy as the other, are dropped to the ground from the roof of a building. Just before hitting the ground, the heavier marble has
- as much kinetic energy as the lighter one.
 - twice as much kinetic energy as the lighter one.
 - half as much kinetic energy as the lighter one.
 - four times as much kinetic energy as the lighter one.
 - impossible to determine
11. When you jump into the air, the floor does work on you, increasing your potential energy. This statement is
- True
 - False
12. A block that is on a table (not frictionless) is pushed to the left by a force equal to 5N. The block moves to the left at a constant speed of 2m/s. We can conclude that the total work done by all forces acting on the object is
- greater than zero.
 - less than zero.
 - equal to zero.
 - unknown.
13. Balls A, B, and C are thrown off a 45m high cliff. Ball A is thrown horizontally with a speed of 25m/s. Ball B is thrown 25 degrees above the horizontal with a speed of 25m/s. Ball C is thrown 25 degrees below the horizontal with a speed of 25m/s. When the balls hit the ground, we can conclude that (assume no air friction)
- ball A hits the ground with the highest speed
 - ball B hits the ground with the highest speed
 - ball C hits the ground with the highest speed
 - they all hit the ground with the same speed
14. If the work done by a force in a closed path (ending point is same as starting point) is not zero then the force is said to be
- Conservative
 - Non-conservative
 - zero
 - left wing

15. Two blocks are released from the top of a height h . One falls straight down while the other slides down a smooth ramp. If all friction is ignored, which one is moving faster when it reaches the bottom?
- The block that went straight down.
 - The block that went down the ramp.
 - They both will have the same speed.
 - Insufficient information to work the problem.
16. Your team of furniture movers wishes to load a truck using a ramp from the ground to the back entrance of the truck. One of the workers claims that less work would be required to load the truck if the length of the ramp were increased since it reduces the angle it makes with the horizontal. You should respond by saying that the ramp helps because
- the required work is the same but the required force decreases.
 - the required work increases but the required force stays the same.
 - the required work decreases but the required force increases.
 - the required work is the same but the required force increases.
 - the required work decreases and the required force decreases .
17. A woman runs up a flight of stairs. The gain in her gravitational potential energy is U . If she runs up the stair at half the speed, her gain in gravitational potential energy will be
- $U/4$
 - U
 - $2U$
 - $4U$
18. An object of mass m moves with a velocity v across a level surface. It comes to rest after traveling a distance d . The work done by friction is
- $-1/2mv^2$
 - $-mvd$
 - 0
 - Can't be determined unless we know the coefficient of kinetic friction.
19. An object of mass m moves is in uniform circular motion across a level surface. Its speed is v . The work that friction does in keeping the car in a circular path is
- $-1/2mv^2$
 - $-mvd$
 - 0
 - Can't be determined unless we know the coefficient of kinetic friction.

20. A force F is applied to the see saw. F is applied a distance $2d$ from the pivot point, and the mass is a distance d from the pivot point. Compare the work done by gravity and the work done by the force F when the see saw is displaced through the angle θ .
- the work done by gravity is greater than the work done by F .
 - the work done by gravity is less than the work done by F .
 - the work done by gravity the same as the work done by F .



21. Two identical objects are accelerated from rest through the same distance by different forces such that one object gains a velocity twice that of the other object. One can conclude that the force on the faster object is
- Half that of the slower object
 - The same as that of the slower object.
 - Twice that of the slower object
 - Four times that of the slower object
22. An open railroad car is coasting horizontally along frictionless rails. A girl on board starts throwing coal backward straight off the car. As a result, the railroad car
- speeds up
 - slows down
 - first speeds up then slows down
 - travels at a constant speed
23. A stunt person jumps from a tall building onto a large inflated pad. One reason why the pad reduces the force of impact is because
- the interaction time is reduced
 - the interaction time is increased
 - the change in velocity is increased
 - the change in velocity is decreased
24. A 12.0-gram bullet traveling at 325m/s is imbedded into a .250 kg block that is resting on a frictionless surface. What is the work done on each object?
- 634J on bullet, 30.4J on block
 - 632J on bullet, 30.4J on block
 - 634J on bullet, 30.4J on block
 - 632J on bullet, 30.4J on block
25. In the above problem, the reason why the work done on each object is different is because
- the force on the bullet is greater than the force on the block.
 - mechanical energy is converted into thermal energy
 - the block is heavier than the bullet.

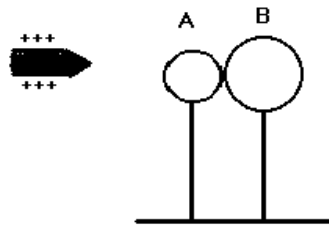
Name _____

Electric Forces and DC Circuits

Please circle the best answer

- A $1.0\mu\text{C}$ charge is placed 0.50m from a $250.0\mu\text{C}$ charge of equal mass. Which charge has a larger Coulomb force acting on it?
 - the $1.0\mu\text{C}$ charge
 - the $250.0\mu\text{C}$ charge
 - the force is same on both!
- The object that has the larger acceleration in the above question is the
 - $1.0\mu\text{C}$ charge
 - $250.0\mu\text{C}$ charge
 - the accelerations are equal!
- Two conducting spheres, A and B, on insulating stands are brought into contact. A positively charged rod is brought near sphere A (without touching) as shown in the figure. While the rod is in place, the two spheres are separated. How will the spheres be charged?

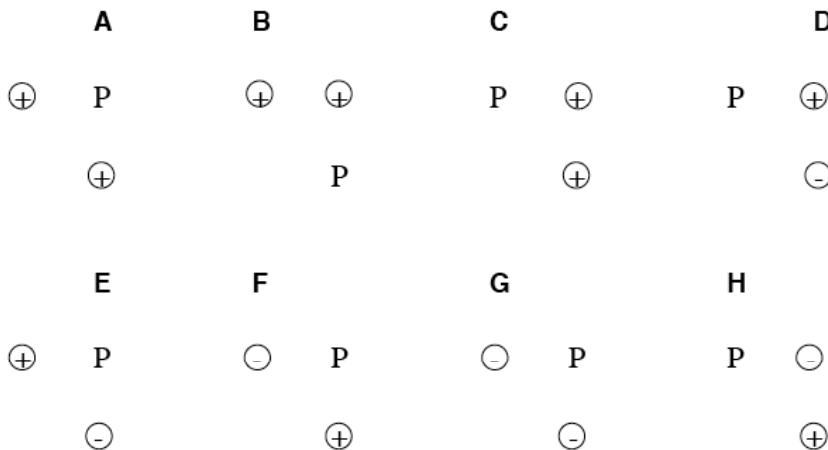
- | A | B |
|-------------|----------|
| A. positive | positive |
| B. positive | negative |
| C. negative | positive |
| D. negative | negative |
| E. zero | zero |



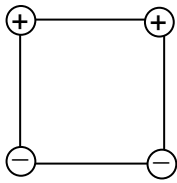
- Please answer the following question. Note ties are possible

Given below are arrangements of two fixed electric charges. In each figure, a point labeled P is also identified. All of the charges are the same size, q , but they can be either positive or negative as indicated. The distances between adjacent items, either between two charges or between a charge and point P, are all the same. There are no other charges in this region. For this problem, we are going to place a test charge, $+Q$, at point P.

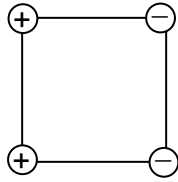
Rank these arrangements from greatest to least on the basis of the strength (magnitude) of the electric force on the test charge, $+Q$, at P.



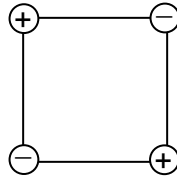
5. Consider the following charge distributions. The magnitudes of the charges at the corners of the square are equal. In which of the following cases is the electric field at the center of the square zero.



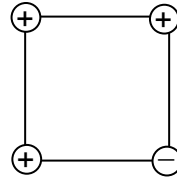
A.



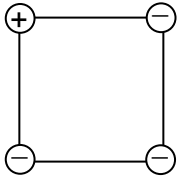
B.



C.



D.



E.

6. If the electric force on an object in a electric field is constant and directed to the left, the acceleration of the object is
- is constant
 - varies linearly with time.
 - varies quadratically with time (depends on t^2).
7. How does the velocity of the object in the previous question vary with time?
- is constant
 - varies linearly with time.
 - varies quadratically with time (depends on t^2).
8. How does the position of the object in question 7 vary with time?
- is constant
 - varies linearly with time.
 - varies quadratically with time (depends on t^2).
9. If the object in problem 7 had an initial velocity directed to the right, the work done by this force is
- Positive
 - Negative
 - Zero
 - Not enough information given.
10. Suppose a potential difference is applied to a conductor that obeys Ohm's Law. Now suppose we double the potential difference across the conductor. Which of the following statements is true about the conductor?
- Its resistance doubles.
 - The current through it doubles.
 - The resistance drops by a factor of two.
 - The power dissipated by the conductor doubles.

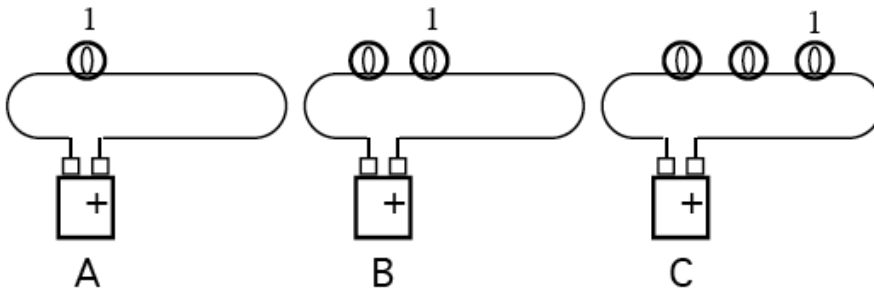
11. Two resistors dissipate the same amount of power. The potential drop across resistor A is twice that across resistor B. If the resistance of B is R , what is the resistance of A?
- e. R
 - f. $2R$
 - g. $R/2$
 - h. $4R$
 - i. $R/4$

In questions 4-7:

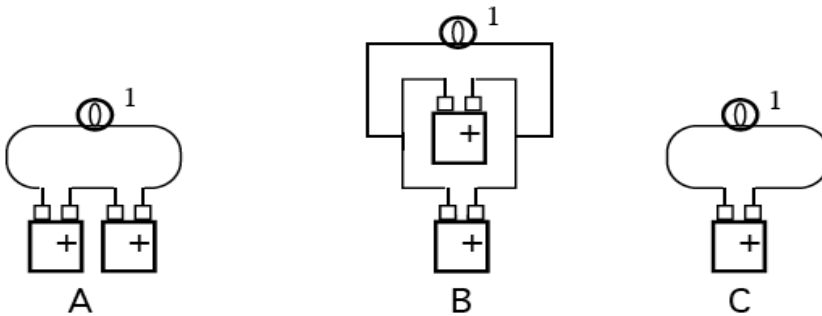
- a) bulbs are identical
- b) treat the bulbs as ohmic resistors
- c) treat the wires as zero resistance connectors
- d) batteries are ideal (no internal resistance)

Note: More than one answer is possible in 4-7.

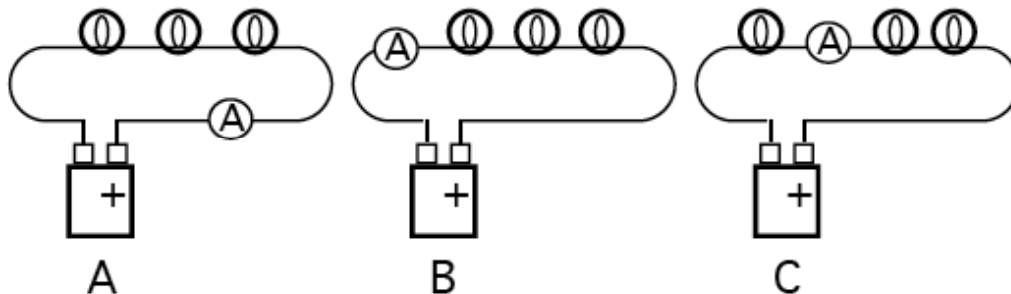
12. In which case is the bulb labeled "1" brightest?



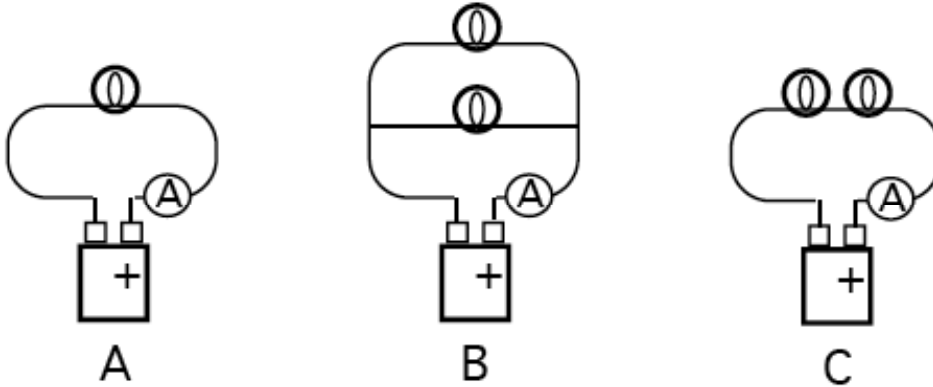
13. In which case is the bulb labeled "1" brightest?



14. In which case is current through the ammeter greatest?



15. In which case is the current through the ammeter greatest?



16. True or False: The equivalent resistance of a network of three parallel resistors is always less than that of the smallest resistance in the network.

17. Which has a larger resistance, a 100W lamp, or a 60W lamp? _____

Refer to the circuit shown below. Positive terminal of battery is shown.

18. All lamps (circles) are identical. Which lamp(s) burn(s) brighter?

- a. A
- b. B
- c. C
- d. C and D
- e. A and B

19. Of the lamps listed below, the larger current is through lamp

- a. A
- b. B
- c. current is same through A and B

20. If lamp A only is unscrewed, which lamp(s) will go out?

- a. B
- b. C
- c. B and C
- d. neither B or C

21. If lamp C only is unscrewed, which lamp(s) will go out?

- a. A only
- b. B only
- c. D only
- d. A,B and D
- e. A and D only

22. Of the lamps listed below, the larger voltage is across

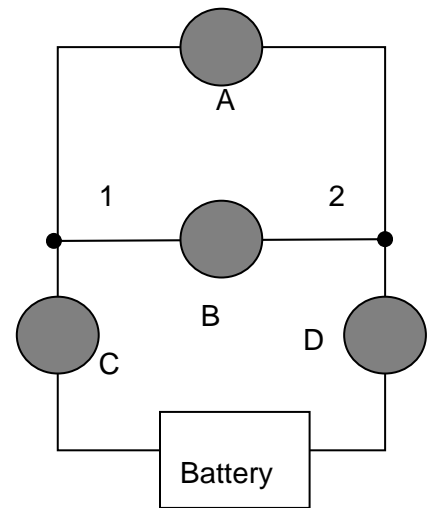
- a. A
- b. C
- c. voltage is same across A and C

23. Of the lamps listed below, the larger current is through lamp

- a. C
- b. D
- c. current is same through C and D

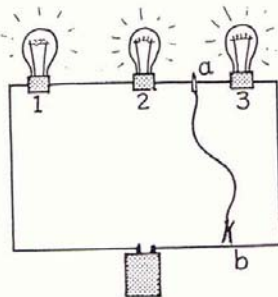
24. If a wire were connected from point 1 to point 2 in the circuit, which lamps would burn?

- a. A
- b. B
- c. A and B
- d. all
- e. C and D



25.

CONCEPTUAL **Physics**



The simple series circuit consists of three identical lamps powered by battery. When a wire is connected between points *a* and *b*,

- what happens to the brightness of lamp 3?
- does current in the circuit increase, decrease, or remain the same?
- what happens to the brightness of lamps 1 and 2?
- does the voltage drop across lamps 1 and 2 increase, decrease, or remain the same?
- is the power dissipated by the circuit increased, decreased, or does it remain the same?