Name:
School:
Score:

Physics

This test will consist of 20 physics questions of various topics and difficulties. You have 1 hour to complete this test. Tiebreakers will be determined based on time turned in. Scientific calculators are permitted, as well as scratch work and any writing utensils, but nothing else. Best of luck!

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1. Robert Tung is a tribute in the hunger games. He's supposed to run 5000 meters 35° east of north to Peeta's cave, but unfortunately he instead runs 4000 meters 20° west of north. He's getting pretty tired, and only has enough strength to run 6 km more. Does he make it to Peeta's cave alive?
   A. Yes. He needs to go 4249 m.
   B. Yes. He needs to go 5464 m.
   C. No. He needs to go 7997 m.
   D. No. He gets ambushed by Cato because of all the noise he's making.

2. A 2m long cannon fires a cannonball that is moving at 1000 m/s when it leaves the cannon. What is the average acceleration of the cannonball?
   A. 500 m/s^2
   $B. 2000 m/s^2$
   $C. 250,000 m/s^2$
   $D. 500,000 m/s^2$

3. A car is moving in a circular path with constant velocity. Which of the following describes the velocity and acceleration of the vehicle?
   A. Velocity tangent to the circle, Acceleration tangent to the circle
   B. Velocity toward the center of the circle, Acceleration tangent to the circle
   C. Velocity tangent to the circle, Acceleration toward the center of the circle
   D. Velocity toward the center of the circle, Acceleration toward the center of the circle

4. Bobby Wang is kayaking upstream when suddenly a gust of wind blows his hat into the stream. For 60 minutes, Bobby keeps paddling and ends up 2 km from where he was. However, he decides at this point that he really likes his hat, so he goes back for it and starts heading downstream. He finally catches up to it 7 km from when he felt the need to turn around. Assuming that Bobby's paddling is constant, how fast is the river flowing and how fast does Bobby paddle without current?
   A. 2.5 km/hr river, 4.5 km/hr Bobby
   B. 1.5 km/hr river, 3.5 km/hr Bobby
   C. 4.5 km/hr river, 2.5 km/hr Bobby
   D. 3.5 km/hr river, 1.5 km/hr Bobby

5. Justin Zhong tries to throw an apple over a wall. The wall is 50 feet away and 15 feet tall. He throws at an angle of 50° with a velocity of 45 ft/second. Assume that when Justin releases the apple, it is 5 feet off the ground. Does the apple make it over the wall? (Assume the acceleration of gravity is 32 ft/s^2).
   A. Yes, it makes it clear over.
   B. No, it hits the wall
   C. No, it doesn't make it to the wall

6. An object with mass 5 moves along the x-axis. Its position as a function of time is given by $x(t) = sin(t)+3sec(t)+2t^4$, where A and B are constants. Calculate the net force on the object as a function of time
   . A. $F(t) = 120t^2 - 15sec^3(t) + 5sin(t) - 15sec(t)tan^2(t)$
   B. $F(t) = 40t^3 + 5cos(t) + 15sec(t)tan(t))$
   C. $F(t) = 5sin(t) + 15sec(t) + 10t^4$
   D. $F(t) = 120t^2 + 15sec^3(t) - 5sin(t) + 15sec(t)tan^2(t)$

7. Which of the following affects the period of a pendulum?
   I. String Length
   II. Mass at end of string
   III. Distance mass is pulled back
   A. I only
   B. I and II
   C. II and III
   D. I and III

8. A step-up transformer has 100 loops in its primary coil and 1600 loops in its secondary coil. What is the voltage in the primary coil if the voltage in the secondary coil is 4,000 volts?
   A. 250 volts
   B. 40 volts
   C. 2.5 volts
   D. 640 volts

9. If a transformer has 40 volts in its in its primary coil and 4000 volts in its secondary coil, and there are 7 amps running through the secondary coil, how much current is in the primary coil?
   A. 1/7 amps
   B. 1/700 amps
   C. 7 amps
   D. 700 amps

10. Which of the following does the length of a wire impact?
    A. Voltage
    B. Resistance
    C. Both voltage and resistance
    D. Neither voltage nor resistance

11. Which of the following optical phenomena is most responsible for mirages?
    A. Diffraction
    B. Reflection
    C. Refraction
    D. Diffusion

12. A charge of $3.7 * 10^{-7}$ Coloumbs is placed inside an electric field. A force of 10 newtons acts on the charge. What is the magnitude of the field intensity where the charge was placed?
    A. $2.7 * 10^{7}$ N/C
    B. $3.7 * 10^{-8}$ N/C
    C. $3.7 * 10^{-6}$ N/C
    D. $2.7 * 10^{-7}$ N/C

13. If an isotope is above the "band of stability," what of the following is the most likely type of radioactive decay that it will undergo?
    A. Positron Emission
    B. Electron Capture
    C. Beta Decay
    D. A and B are equally likely

14. Two charges are separated by 4 meters. If the distance between the charges is increased to 8 meters, and the magnitude of each charge is tripled, how much stronger is the force between the charges?
    A. 2.25 times stronger
    B. 18 times stronger
    C. 1.5 times stronger
    D. 0.66 times stronger

15. At the TAMS carnival funhouse, there is a concave mirror that has a focal length of 4 meters. A 2 meter tall man stands 16 meters from the mirror. How far away is his image? How large is his image?
    A. 5.33 meters away, 0.66 meters tall
    B. 0.19 meters away, 0.66 meters tall
    C. 5.33 meters away, 1.5 meters tall
    D. 0.19 meters away, 1.5 meters tall

16. A magnetic loop exerts a torque on a round current carrying wire. What will happen to the torque if the wire's diameter is tripled?
    A. It will be 1/9 times as strong
    B. It will be 1/3 times as strong
    C. It will be 3 times as strong
    D. It will be 9 times as strong

17. Two light bulbs have resistances of R_1= 600 ohms and R_2 =1000 ohms. If the two light bulbs are connected in parallel across a 150-V line, find the power dissipated in each bulb.
    A. P1 = 60.0 W, P2 = 100.0 W
    B. P1 = 37.5 W, P2 = 22.5 W
    C. P1 = 40.0 W, P2 = 25.0 W
    D. P1 = 50.0 W, P2 = 37.5 W

18. Imagine a particle that has a charge of -1.2C and mass of .5kg is moving straight forward on this sheet of paper at a speed of 3.5 m/s. It enters a Magnetic field pointing into the page of magnitude 1.5 T. What is the direction and the radius of the circle that the charge will begin spinning in?
    A. Right, 35/36 m
    B. Left, 35/36 m
    C. Right, 17/18 m
    D. Left, 17/18 m

19. A circular copper wire is placed on a flat surface with a magnetic field of 1.2 T coming out of the surface. Which of the following changes will induce an EMF?
    A. Moving the wire to the left
    B. Moving the wire to the right
    C. Rotate the wire
    D. No way to induce EMF

20. A copper wire of radius 1m has an electric current of 2A running through it. What is the magnetic field induced by this current at a distance of 2m away from the center of the wire? $0 = 4\pi * 10^{-7}$.
    A.2.0*10^{-8}
    B. $2.0 * 10^{-7}$
    C. $4.0 * 10^{-7}$
    D. $2.0 * 10^{-8}$