Part 1.

Please read each question carefully. Each question worth's 1 point. For the following questions, please circle ◯ the correct answer to the nearest number for the quantitative ones.

1. To say that electric charge is **conserved** is to say that electric charge

(A) may occur in an infinite variety of quantities.
(B) can neither be created or destroyed.
(C) is a whole−number multiple of the charge of one electron.
(D) will interact with neighboring electric charges.
(E) is equal to the number of electrons multiply by the charge of the electron.

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2. Two charged particles repel each other with a force ***F***. If the charge of one of the particles is **doubled** and the distance between them is also **doubled**, then the force will be

(A) *F* (B) *2F* (C) *F/2* (D) *F/4* (E) None of these

3. A car starts from rest and accelerates at a constant rate in a straight line. In the ***first*** **second** the car covers a distance of **2.0 meters**. How much distance will the car cover during the ***second*** **second** of its motion?

(A) 2.0 m (B) 4.0 m (C) 8.0 m (D) 6.0 m (E) 13 m

4. An electron is pushed into an electric field where it acquires a **1.0 V** electrical potential. If two electrons are pushed the same distance into the same electric field, the electrical potential of the two electrons is?

(A) 0.25 V (B) 1.0 V C) 0.50 V D) 2.0 V E) 4.0 V

5. A circuit is powered with a battery. Current flows

(A) out of the battery and into the circuit. (B) after a couple seconds passes.
(C) from the negative battery terminal to the positive terminal.
(D) through the battery and the rest of the circuit. (E) none of the above.

6. A rock is dropped from rest from a height ***h*** above the ground. It falls and hits the ground with a speed of **11 m/s**. From what height should the rock be dropped so that its speed on hitting the ground is **22 m/s**? Neglect air resistance.

(A) 1.4*h*. (B) 2.0*h*. (C) 3.0*h*. (D) 4.0*h*. (E) 0.71*h*.

7. Two satellites of different masses are in the same circular orbit about the earth. Which one of the following statements is true concerning the magnitude of the gravitational force that acts on each of them?

(A) The magnitude of the gravitational force is zero newtons for both satellites.
(B) The magnitude of the gravitational force is the same for both satellites, but not zero newtons.
(C) The magnitude of the gravitational force is zero newtons for one, but not for the other.
(D) The magnitude of the gravitational force depends on their masses.
(E) The magnitude of the gravitational force varies from point to point in their orbits.

8. In which one of the following situations is **zero net work done**?

(A) A ball rolls down an inclined plane.
(B) A physics student does work to stretch a spring.
(C) A projectile falls toward the surface of Earth.
(D) A box is pulled across a rough floor at constant velocity.
(E) A child pulls a wagon across a rough surface causing it to accelerate.

9. Which one of the following statements concerning momentum is true?

(A) Momentum is a force. (B) Momentum is a scalar quantity.
(C) The unit of momentum is $kg \cdot m^2/s$.
(D) The momentum of an object is always positive.
(E) Momentum and impulse are measured in the same units.

10. Which one of the following statements concerning kinetic energy is true?

(A) Kinetic energy can be measured in watts.
(B) Kinetic energy is always equal to the potential energy.
(C) Kinetic energy is a quantitative measure of inertia.
(D) Kinetic energy is always positive.
(E) Kinetic energy is directly proportional to velocity.

11. Two balls of equal size are dropped from the same height from the roof of a building. One ball has **twice** the mass of the other. When the balls reach the ground, how do the kinetic energies of the two balls compare?

(A) The lighter one has one half as much kinetic energy as the other does.
(B) The lighter one has one fourth as much kinetic energy as the other does.
(C) The lighter one has the same kinetic energy as the other does.
(D) The lighter one has twice as much kinetic energy as the other does.
(E) The lighter one has four times as much kinetic energy as the other does.

12. How much power is needed to lift a **75 kg** student vertically upward at a constant speed of **0.33 m/s**?

(A) 12.5 W (B) 25 W (C) 115 W (D) 247 W (E) 230 W

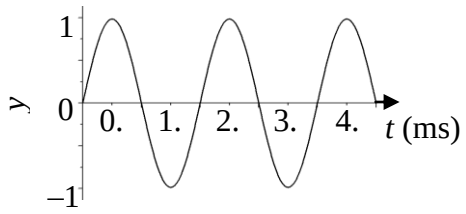
13. A **1.0 kg** ball has a velocity of **12 m/s** downward just before it strikes the ground and bounces up with a velocity of **12 m/s** upward. What is the change in momentum of the ball?

(A) zero kg · m/s (B) 12 kg · m/s, upward
(C) 12 kg · m/s, downward (D) 24 kg · m/s, downward
(E) 24 kg · m/s, upward

14. Complete the following statement: Momentum will be conserved in a two-body collision *only if*

(A) both bodies come to rest. (B) the collision is perfectly elastic.
(C) the net external force acting on the two-body system is zero.
(D) the kinetic energy of the system is conserved.
(E) the internal forces of the two body system cancel in action-reaction pairs.

15. The speed of sound in a certain metal block is **3.00×10^3 m/s**. The graph shows the amplitude (**in meters**) of a wave traveling through the block versus time (**in milliseconds**). What is the wavelength of this wave?

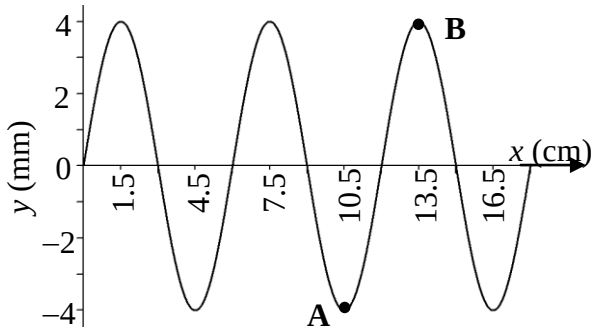


(A) 0.5 m (B) 1.5 m
(C) 3.0 m (D) 6.0 m.
(E) 4.0 m

16. A stationary railroad whistle is sounded. An echo is heard **5.0 seconds** later by the train's engineer. If the speed of sound is **343 m/s**, how far away is the reflecting surface?

(A) 858 m (B) 68 m (C) 140 m (D) 1715 m (E) 2000 m

17. The displacement of a vibrating string versus position along the string is shown in the figure. The periodic waves have a speed of **10.0 cm/s**. **A** and **B** are two points on the string.
What is the amplitude of the wave?



(A) 2 mm (B) 12 mm
(C) 4 mm (D) 8 mm
(E) 16 mm

18. **Refer to the figure in question 17**, what is the frequency of the wave?

(A) 0.60 Hz (B) 1.7 Hz (C) 0.90 Hz (D) 1.1 Hz (E) 1.3 Hz

19. A floating leaf oscillates up and down **two complete cycles each second** as water wave passes by. What is the wave's frequency?

(A) 0.5 Hz (B) 1 Hz (C) 2 Hz (D) 3 Hz (E) 6 Hz

20. The period of the seconds hand on a clock is

(A) 1 s. (B) 1/60 s (C) 60 s (D) 3600 s (E) 12 hours

21. A **4.0 Ω** resistor is connected in parallel with a **6.0 Ω** resistor. This combination produces an equivalent resistance of

(A) 5.5 Ω (B) 10 Ω (C) 2.4 Ω (D) 0.42 Ω (E) 0.25 Ω

22. A positive ion has more

(A) electrons than neutrons.
(B) electrons than protons.
(C) protons than neutrons.
(D) neutrons than electrons.
(E) protons than electrons.

Part 2:

Please read each question carefully and show your steps in the space provided with the appropriate units to receive partial credit. No credit will be given for writing down formulae. ***Draw a Free Body Diagram when is needed.***

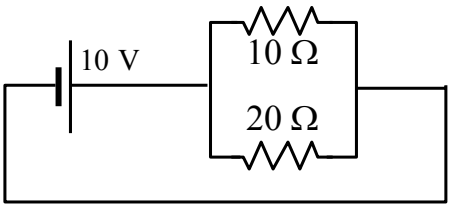
P.1. A tennis ball is thrown from ground level with velocity v_0 directed ***45°*** above the horizontal. If it takes the ball ***1.0 s*** to reach the top of its trajectory, what is the total vertical distance travelled by the ball when it hits the ground again? ***(5 points)***

Answer_____

P.2. A **15 N** net force is applied for **6.0 s** to a **12 kg** box initially at rest. What is the speed of the box at the end of the **6.0 s** interval? ***(4 points)***

Answer_____

P.3. What is the total power dissipated in the two resistors in the circuit shown? ***(5 points)***



***Answer*_____**

P. 4. A **1000 kg** car traveling east at **20 m/s** collides with a **1500 kg** car traveling west at **10 m/s**. The cars stick together after the collision. What is the common velocity of the cars after the collision? ***(5 points)***

***Answer (magnitude)*_____**
***Answer (direction)*_____**

P. 5. A grocery cart of mass **20.0 kg** is moving with an initial speed of **3.0 m/s**. If the stopping force acting on the cart by the floor is **15.0 N**. Find the time it takes the cart to stop? ***(4 points)***

Answer_____

Some useful constants:

g=10 m/s^2 ***k* = 9.0x10^9 N.m^2/C^2** **G=6.67x10^{-11} N.m^2/kg^2**

Good Luck