Physics 30S Exam Review #1

Sample Multiple Choice Questions

1. Which of the following is a scalar quantity?

   (A) mass
   (B) weight
   (C) acceleration
   (D) force

Questions 2 and 3 refer to the following material.

Jeremy walks 4 blocks east and 2 blocks south

2. What distance does Jeremy travel?

   (A) 4.5 blocks
   (B) 6 blocks 27° S of E
   (C) 6 blocks
   (D) 4.5 blocks 27° S of E

3. What is his displacement?

   (A) 4.5 blocks
   (B) 6 blocks 27° S of E
   (C) 6 blocks
   (D) 4.5 blocks 27° S of E

4. Suppose that a car traveling to the East (+x direction) begins to slow down as it approaches a traffic light. Make a statement concerning its acceleration.

    (A) The acceleration is positive.

    (B) The acceleration is negative.

    (C) The acceleration is zero.

5. Objects A and B both start at rest. They both accelerate at the same rate. However, object A accelerates for twice the amount of time as object B. What is the final speed of object A compared to that of object B?

    (A) the same speed

    (B) twice as fast

    (C) three times as fast

    (D) four times as fast

6. Suppose a ball is thrown straight up. Make a statement about the velocity and the acceleration when the ball reaches the highest point.

    (A) Both its velocity and its acceleration are zero.

    (B) Its velocity is zero and its acceleration is not zero.

    (C) Its velocity is not zero and its acceleration is zero.

    (D) Neither its velocity nor its acceleration is zero.

7. An airplane increases its speed from 100 m/s to 160 m/s, at the average rate of 15 m/s^2. How much time does it take for the complete increase in speed?

    (A) 17 s

    (B) 0.058 s

    (C) 4.0 s

    (D) 0.25 s

8. A space shuttle turns on its thrusters and accelerates at 20.5 m/s^2 for 9 seconds. If its initial velocity was 160 m/s, what is the magnitude of its final velocity?

   (A) 345 m/s
   (B) 181 m/s
   (C) 185 m/s
   (D) 362 m/s

9. A runaway wagon starts rolling down a hill at 2 m/s. It accelerates for 2.5 s until it hits a wall 34 m from the top of the hill. How fast was the wagon going when it hit the wall?

   (A) 14 m/s
   (B) 25 m/s
   (C) 16 m/s
   (D) 170 m/s

10. A car starts from rest and accelerates uniformly at 3.0 m/s^2. A second car starts from rest 6.0 s later at the same point and accelerates uniformly at 5.0 m/s^2. How long does it take the second car to overtake the first car?

   (A) 12 s
   (B) 19 s
   (C) 21 s
   (D) 24 s

11. A ball is thrown upward at a velocity of 19.6 m/s. What is its velocity after 3.00 s?

   (A) 9.8 m/s upward
   (B) 9.8 m/s downward
   (C) zero
   (D) 19.6 downward

12. The Mars Rover drops a pebble that strikes the surface of Mars at a speed of 3.7 m/s in 1 s. What is the acceleration due to gravity on Mars given this data?

(A) 3.7 m/s^2

(B) 9.8 m/s^2

(C) 0.3 m/s^2

(D) 1.6 m/s^2

13. A cart with an initial velocity of 5.0 m/s experiences a constant acceleration of 2.0 m/s^2. What is the cart's displacement during the first 6.0 s of its motion?

(A) 10 m

(B) 55 m

(C) 66 m

(D) 80 m

14. A bullet moving horizontally in the positive direction with a speed of 500 m/s strikes a sandbag and penetrates a distance of 10.0 cm. What is the average acceleration of the bullet?

(A) -1.25x10^6

(B) -2.50x10^6

(C) -1.25x10^3

(D) -2.50x10^3

15. A jet fighter plane is launched from a catapult on an aircraft carrier. It reaches a speed of 42 m/s at the end of the catapult, and this requires 2.0 s. Assuming the acceleration is constant, what is the length of the catapult?

(A) 16 m

(B) 24 m

(C) 42 m

(D) 84 m

**Questions 16 and 17 refer to the following material.**

The following graph represents a student walking in a hallway.
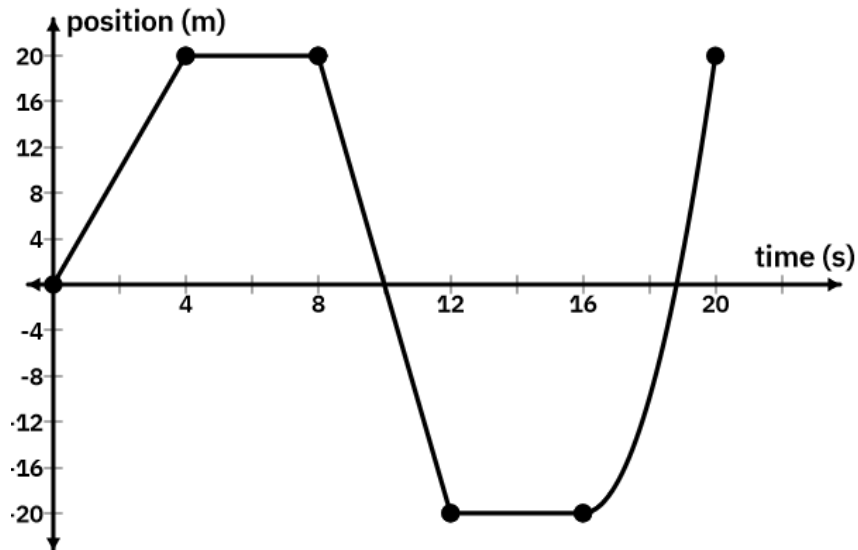
16. During which of the following time intervals was the student traveling forward at a constant speed?

(A) 0-4 s

(B) 4-8 s

(C) 12-16 s

(D) 16-20 s

17. The student's average velocity over the entire 20 seconds was

(A) 20 m/s forward

(B) 5 m/s forward

(C) 1 m/s forward

(D) 13.6 m/s forward

Questions 18 and 19 refer to the following material.

The following graph represents a car driving in a parking lot.
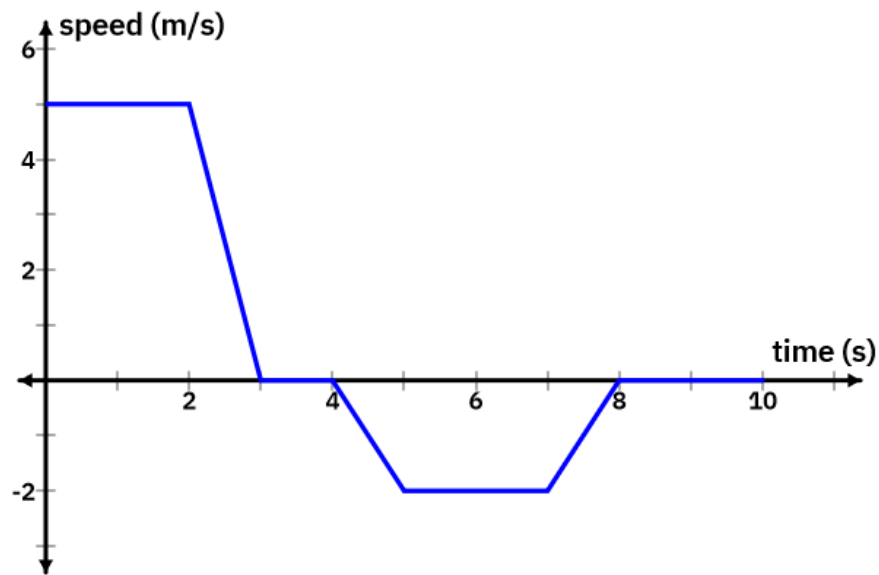
18. During which time interval is the car increasing in speed?

   (A) 0 – 2 s
   (B) 2 – 3 s
   (C) 4 – 5 s
   (D) 7 – 8 s

19. What is the total displacement of the car?

   (A) 18.5 m backwards
   (B) 18.5 m forwards
   (C) 6.5 m forwards
   (D) 6.0 m backwards

20. Which of the following is not a fundamental force of nature?

    (A) strong nuclear force
    (B) friction
    (C) gravitational force
    (D) electromagnetic force

21. In the absence of an external force, a moving object will

    (A) stop immediately.
    (B) slow down and eventually come to a stop.
    (C) go faster and faster.
    (D) move with constant velocity.

22. An object sits on a flat table. The Earth pulls on this object with force F_g, which we will call the action force. What is the reaction force?

    (A) The table pushing up on the object with force F_g.
    (B) The object pushing down on the table with force F_g.
    (C) The table pushing down on the floor with force F_g.
    (D) The object pulling upward on the Earth with force F_g.

23. An object sits on a frictionless surface. A 16 N force is applied to the object, and it accelerates at 2.0 m/s². What is the mass of the object?

    (A) 4.0 kg
    (B) 8.0 kg
    (C) 32 kg
    (D) 78 N

24. An object's weight is

    (A) the same as its mass.
    (B) is always a constant value.
    (C) is equal to its mass multiplied by the gravitational acceleration.
    (D) is equal to its mass multiplied by 9.8.

25. Carlos (63 kg) is standing on a scale in an elevator that is accelerating down at 1.3 m/s^2. What does the scale read?

    (A) 82 N
    (B) 536 N
    (C) 699 N
    (D) 617 N

26. A 1 kg object is on a frictionless inclined plane. The plane is inclined at an angle of 30° above the horizontal. What is the object's acceleration?

    (A) 5 m/s^2
    (B) 6 m/s^2
    (C) 9 m/s^2
    (D) 10 m/s^2

27. A 50 kg box is pulled across a rough floor at a constant velocity with a force of 200 N at an angle of 30° above the horizontal. The coefficient of kinetic between the box and the floor is

    (A) 0.4
    (B) 0.3
    (C) 0.2
    (D) 0.1

28. A box rests on an inclined plane as shown.
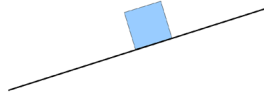
Which of the following statements are true?

(A) The weight and the normal force are equal and act in opposite directions.

(B) The weight and the force of friction are equal and act in opposite directions.

(C) The normal force and the force of friction are equal and act in opposite directions.

(D) The normal force is perpendicular to the surface.

29. During the investigation of a traffic accident, police found skid marks 90.0 m long. They determined the coefficient of friction between the car's tires and the roadway to be 0.500 for the prevailing conditions. Estimate the speed of the car when the brakes were applied.

(A) 9.49 m/s

(B) 21.0 m/s

(C) 29.7 m/s

(D) 42.0 m/s

30. Which statement about friction is true?

(A) The static coefficient of friction is always greater than the kinetic coefficient for the same materials.

(B) The force of friction on an object depends on the areas in contact between the two surfaces.

(C) The force of friction on an object changes as the object moves faster.

(D) As the normal force increases, the force of friction on an object decreases.

31. Which of the following diagrams correctly shows the electric field lines surrounding two point charges?

(A)

(B)

(C)

(D)
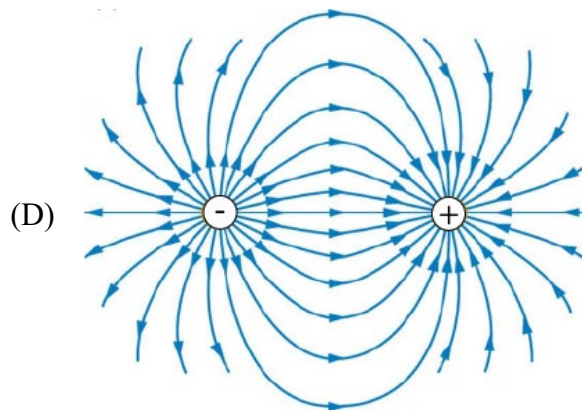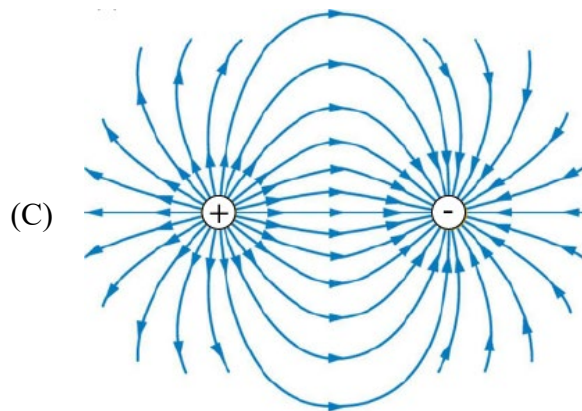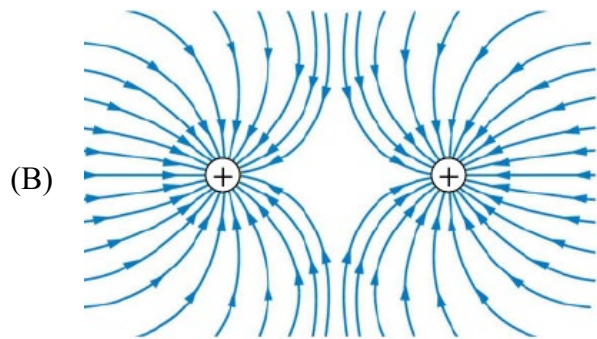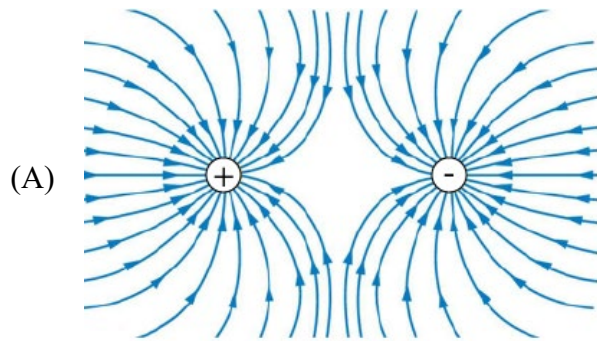
32. An electron experiences of force of 2×10^{-16} N to the left. What is the magnitude and direction of the electric field at this point?

(A) 1250 N/C left

(B) 1250 N/C right

(C) 750 N/C left

(D) 500 N/C right

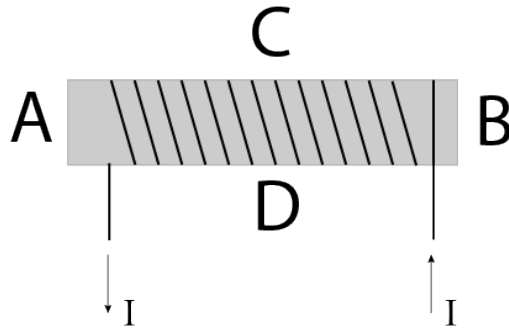33. Which of the following correctly shows the magnetic field lines around a bar magnet?

(A)

(B)

(C)

(D)
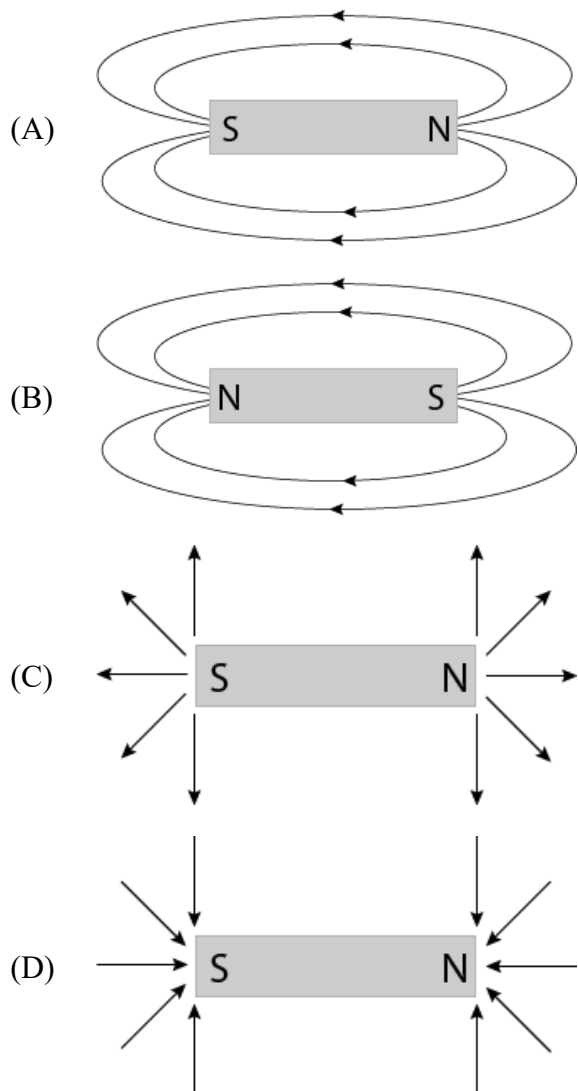
34. Which of the following diagrams correctly shows the magnetic field around a current carrying wire?

(A)

(B)

(C)

(D)
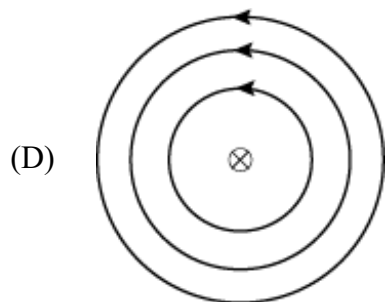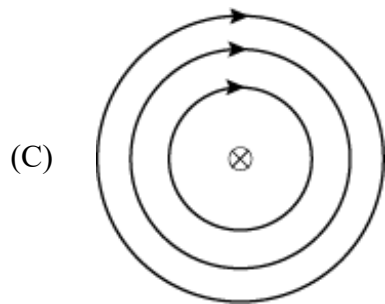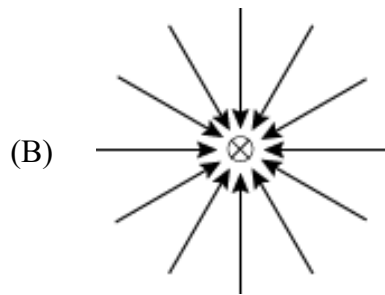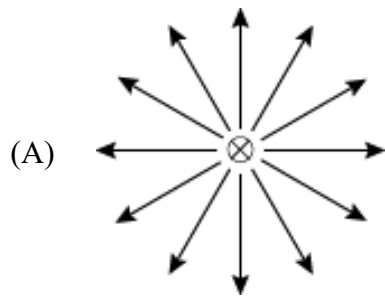
35. Current flows through a solenoid as shown.

At which position does a north pole occur?

(A) A

(B) B

(C) C

(D) D

36. A 1.5 m wire carrying a current of 3.0 A west is placed in a magnetic field 4.0 T north. What is the force on the wire?

(A) 0.9 N down

(B) 0.9 N up

(C) 18 N down

(D) 18 N up

37. A 3.0 cm wire has a mass of 0.25 g. The wire is suspended in magnetic field of 3.5 T north by running a current through the wire. What is the magnitude and direction of the current in the wire?

(A) 0.23 A east

(B) 0.023 A east

(C) 0.23 A west

(D) 0.023 A west

Questions 38 and 39 refer to the following material.

The following image shows a wave on a string at a single point in time.
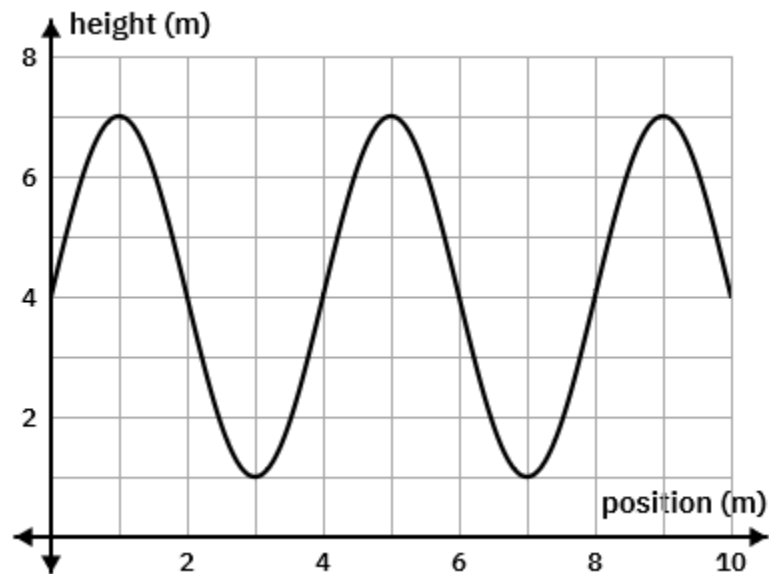
38. The amplitude of the wave is

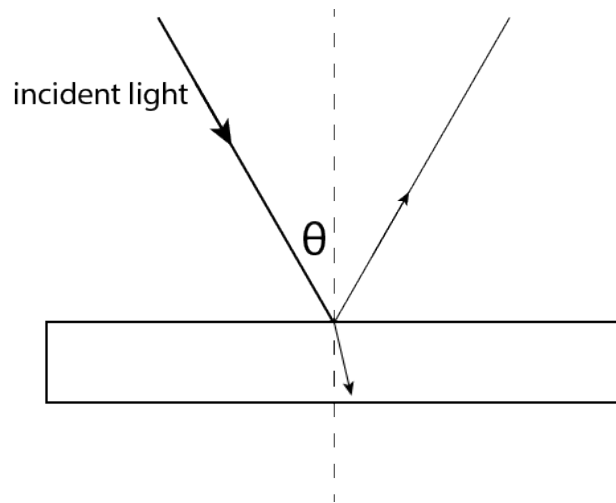   (A) 7 m
    (B) 4 m
    (C) 3.5 m
    (D) 3 m

39. The wavelength of the wave is

    (A) 7 m
    (B) 4 m
    (C) 3.5 m
    (D) 3 m

40. You are watching the waves roll in on the beach. In one minute, you count 15 waves. The frequency of the waves is

(A) 15 Hz

(B) 4 Hz

(C) 0.25 Hz

(D) 0.07 Hz

**Questions 41 and 42 refer to the following material.**

Laser light is incident on a piece of crown glass (n=1.55) at an angle of $\theta = 30°$ as shown.

41. The light reflects off the surface of the glass at an angle of

(A) 19°.

(B) 30°.

(C) 60°.

(D) 90°.

42. The angle of refraction in the glass is

(A) 19°.

(B) 30°.

(C) 60°.

(D) 90°.

43. Waves bend as they pass through a narrow opening. This phenomenon is called

   (A) refraction.
   (B) reflection.
   (C) diffraction.

44. While standing still at a crosswalk you hear the siren of a police car rising in frequency. This means that the police car

   (A) is coming towards you.
   (B) is moving away from you.
   (C) is stationary.

45. The following standing wave is observed on a 1.2 m long string.
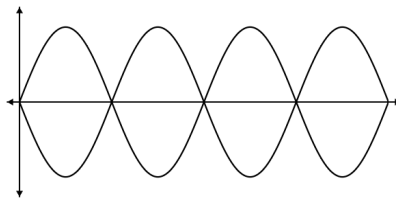
   The frequency of the standing wave 1200 Hz, what is the speed of the wave on the string?

   (A) 720 m/s
   (B) 960 m/s
   (C) 1440 m/s
   (D) 1920 m/s

Sample Free Response Questions

1. Jenny goes for a ride on a waterslide. She starts at 1 m/s and accelerates at 2.3 m/s^2 all the way down.

   (a) If it takes her 5 seconds to reach the bottom, how fast is she going at the bottom of the slide?

   (b) What is Jenny's average speed during her ride down the waterslide?

2. A woman on a bridge 75.0 m high sees a raft floating at a constant speed on the river below. Trying to hit the raft, she drops a stone from rest when the raft has 7.00 m more to travel before passing under the bridge. The stone hits the water 4.00 m in front of the raft. Calculate the speed of the raft.

3. Three dogs are pulling on a doggie toy. Dog A pulls with a force of 75 N to the North, dog B pulls with a force of 55 N East, and dog C pulls with a force of 35 N West.

    (a) The dot represents the center of mass of the toy. Draw a free-body diagram showing and labeling all the forces exerted on the toy.

   (b) Calculate the net force acting on the toy.

4. A boy pulls a sled of mass 25 kg along a horizontal snow-covered surface. He pulls with a force of 62 N at an angle of 35° above the horizontal. The coefficient of kinetic friction between the sled and the snow is 0.20.

(a) The dot represents the center of mass of the sled. Draw a free-body diagram showing and labeling all the forces exerted on the sled.

●

(b) Calculate the acceleration of the sled.

5. An oil drop of mass 1.96×10^{-15} kg is suspended between two parallel plates creating an electric field of 24 000 N/C down as shown.
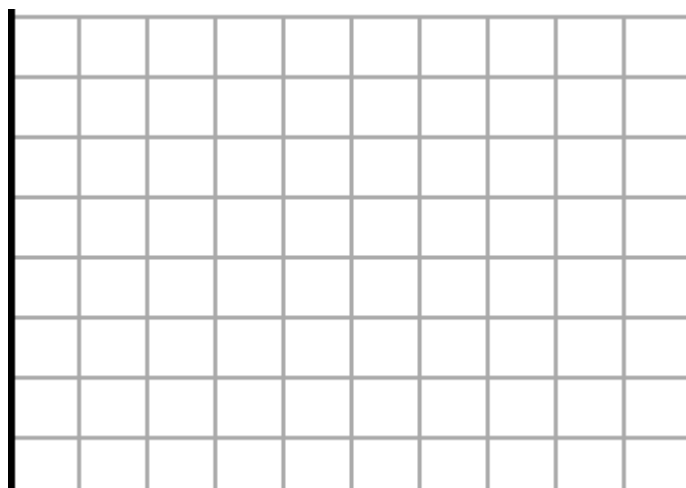
$$+$$

$$-$$
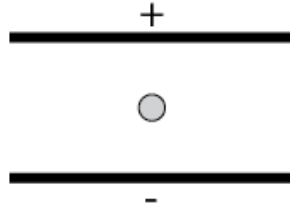
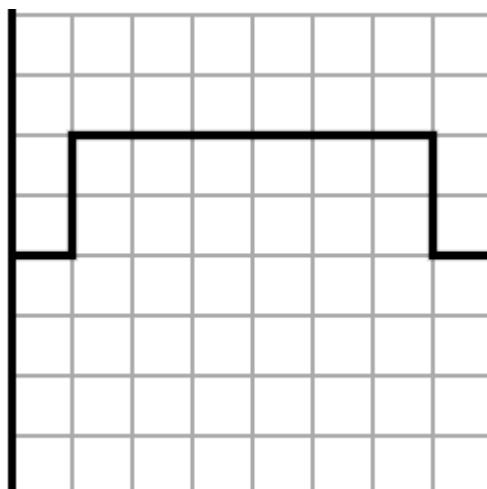Calculate the charge on the oil drop.

6. An 8.0 m length of current carrying wire is placed in a magnetic field of 0.40 T West. If the wire experiences a force of 8.3 N down, what is the magnitude and direction of the current in the wire?

7. Sketch the superposition of wave pulses A and B when they completely overlap.

Wave Pulse A   Wave Pulse B

8. The light from an aquarium bulb travels from water (n = 1.33) to glass (n = 1.58). The light strikes the glass at an angle of 15°.

   (a) What is the angle of refraction?

   (b) Calculate the speed of light in the glass.

9. A closed tube has a third harmonic at 660 Hz. The speed of sound is 344 m/s.

(a) What is the length of the tube.

(b) What is the frequency of the next highest harmonic.

10. In a Young's Double Slit experiment 680 nm light is shone through two slits. The interference pattern appears on a screen 2.0 m away. The distance between 8 consecutive bright spots on the screen is 4.2 cm.

(a) What is the distance between the slits?

(b) If light of a higher frequency was used, would the spacing of the bright spots on the screen increase or decrease? Justify your answer.