Physics 30S Exam Review

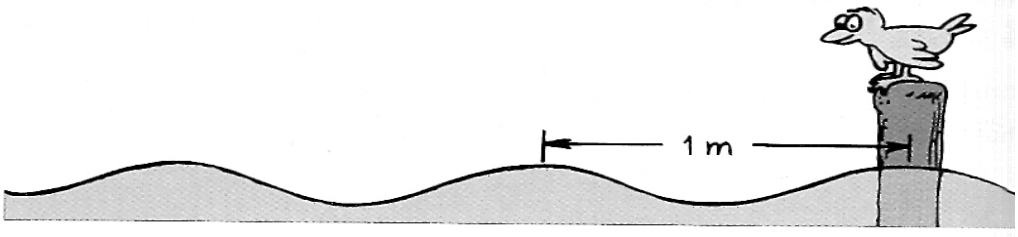
Sample Extended Answer Questions

I: Waves

1. On the grid below, each block represents **1 cm**. Sketch **two** wavelengths of a wave with the following characteristics

   a) wavelength of 6 cm
   b) amplitude of 4 cm

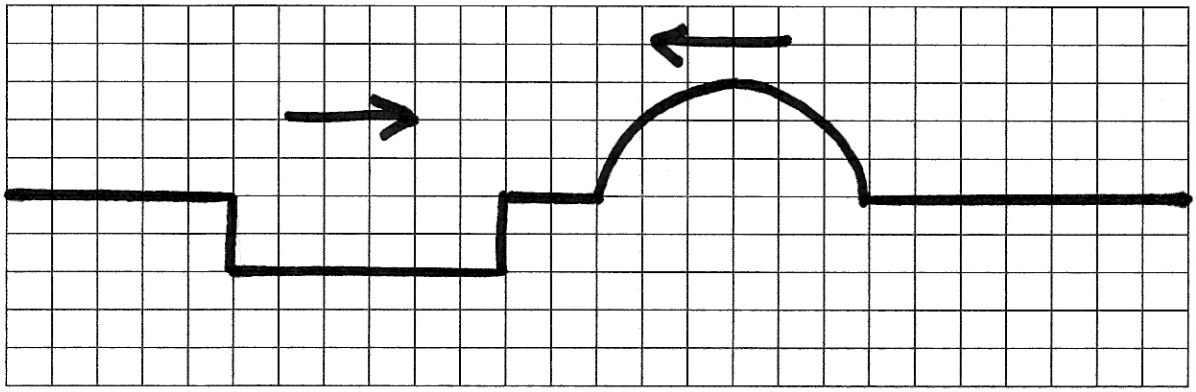
2. Tweetie is perched on a stump in the water. He counts 15 waves go by in 12 seconds.



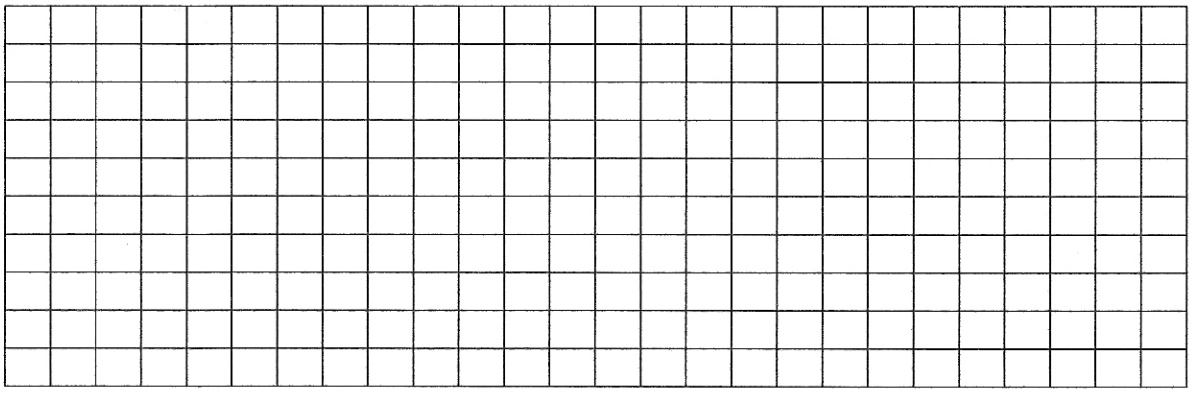
   a) What is the frequency and period of the waves?

   b) If Tweetie estimates the wavelength to be 1 m, what is the speed of the waves?

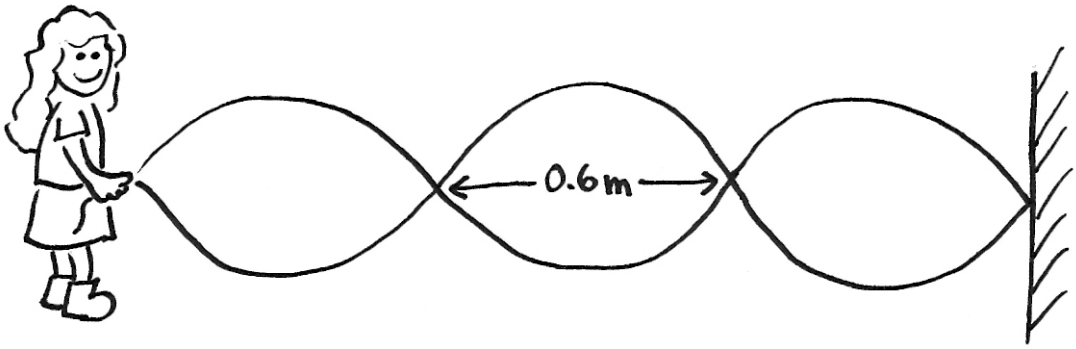
3. The waves shown below are moving toward each other at a rate of 1 space per second. Sketch the resultant wave pattern at t =5 s.



t = 5 s



4. A student makes a standing wave pattern with a skipping rope as shown. If the waves are moving at 7 m/s, with what frequency does the student move her hand up and down?



5. A light beam from a sparkling diamond (n = 2.42) escapes into the air (n = 1.00).

   a) If the angle of incidence is 20˚, what is the angle of refraction?

   b) Calculate the speed of light in the diamond.

II: The Nature of Light

1. Identify and explain an experiment that proves light behaves as a particle.

2. Identify and explain an experiment that proves light behaves as a wave.

3. A viewing screen is separated from a double-slit source by 1.2 m. The distance between the two slits is 0.030 mm. The second-order bright fringe (n=2) is 4.5 cm from the center line.

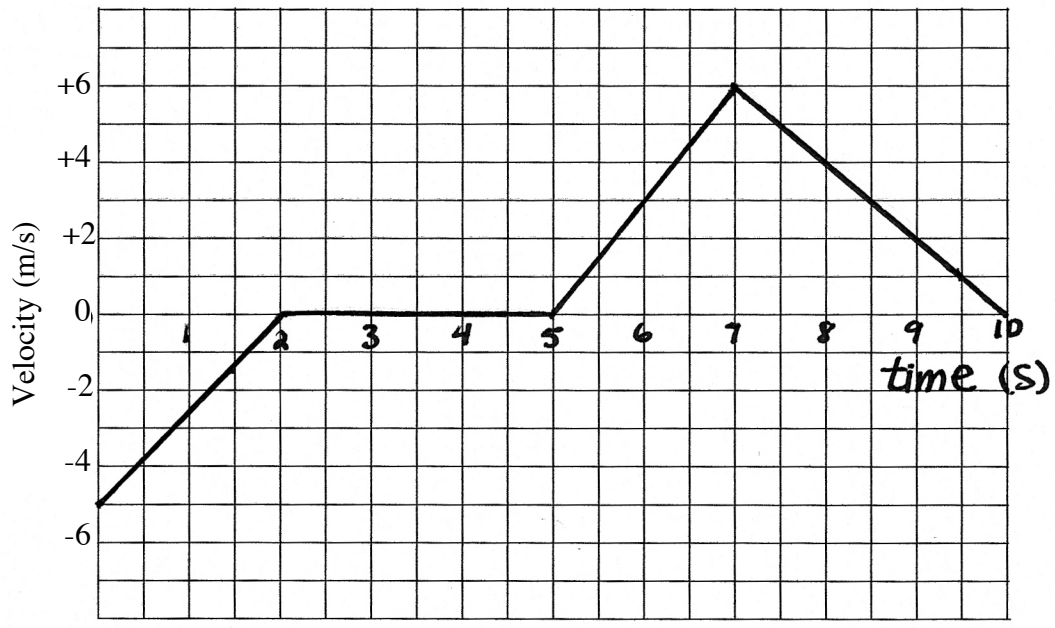
   a) Determine the wavelength of the light.

   b) Calculate the distance from one bright spot to the next.

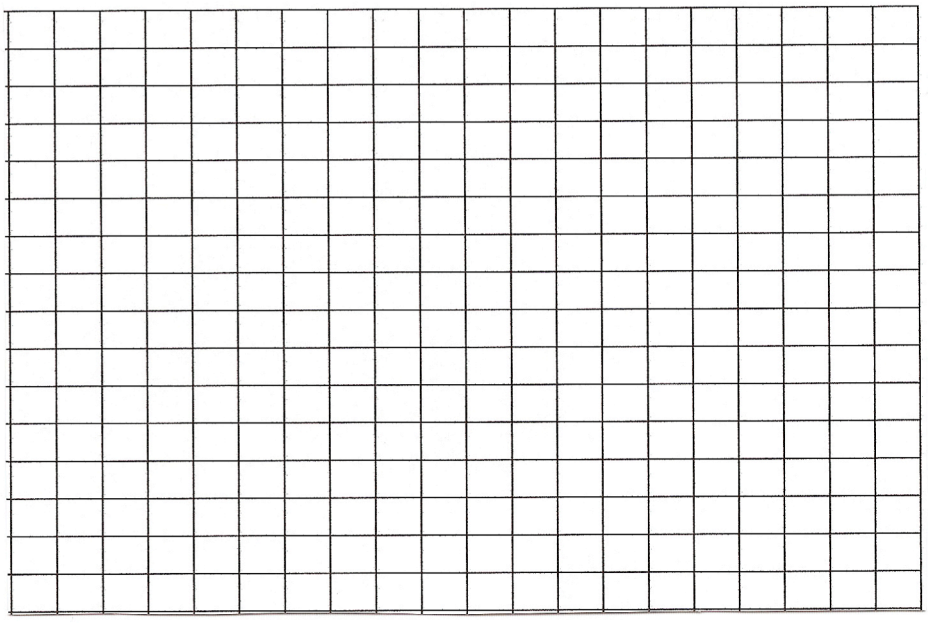
   c) If the screen is moved further away from the light, describe what would happen to the interference pattern as seen on the screen.

III: Mechanics

1. The following graph shows the velocity of an object over a 10 s time interval.



Translate the velocity-time graph into a position-time graph in the space provided. Be sure to label your axes. You may assume the object starts at the origin.



2. As Rebecca is driving in her car, she speeds up from 10 km/h to 50 km/h in 5.5 seconds.

   a) What is her acceleration in m/s^2?

   b) What is the total distance she traveled during this time?

3. Three early-birds are fighting for the same worm. Blue Jay pulls with a force of 70 N to the North, Robin pulls with a force of 50 N East, and Sparrow pulls with a force of 30 N West.

   a) Draw a free body diagram showing all the forces acting on the worm.

   b) Determine the net force acting on the worm.

4. As Tyler mows the lawn, he applies a force of 35 N at an angle of 25º down from the horizontal. The lawn mower is 25 kg, and a 20 N force of friction opposes the motion of the mower.

   a) Calculate the net force causing the mower to accelerate.

   b) Determine the mower's acceleration.

IV: Fields

1. A 75 kg man stands on a scale in an elevator. What is the scale reading, **in Newtons**, when the elevator is

   a) at rest?

   b) accelerating upward at 2 m/s^2?

2. A waiter is sliding an 8 kg dish bin across a counter at a constant velocity.

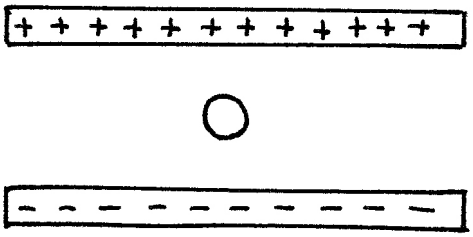
   a) If the waiter provides a 7 N force to keep the bin moving forwards, what is the frictional force acting on the bin?

   b) What is the coefficient of kinetic friction between the bin and the counter?

   c) Would you expect the value obtained in part b to be greater or less than the coefficient of **static** friction between the bin and the counter? Why?

3. An oil drop of mass 2.03×10^{-15} kg is suspended (not moving) between two parallel plates creating an electric field of 25 000 N/C down as shown.

   a) Draw the force vectors acting on the drop.



   b) Is the charge on the oil drop positive or negative?

   c) Calculate the charge on the oil drop in Coulombs.

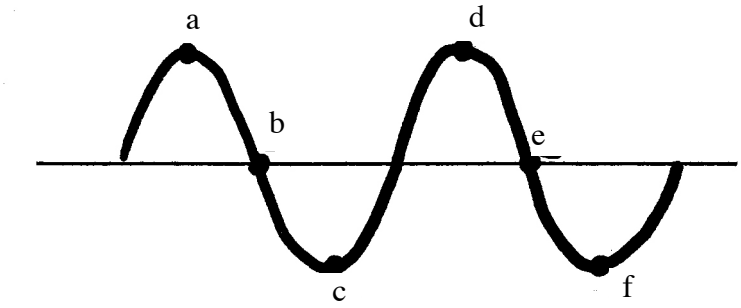
   d) How many electrons did the drop gain or lose? (Include whether it gained or lost electrons in your answer.)

4. A 10 m length of wire carrying a current of 2.7 A North is placed in a magnetic field. If the wire experiences a force of 6.2 N into the page, what is the magnitude and direction of the magnetic field?

Sample Multiple Choice Questions

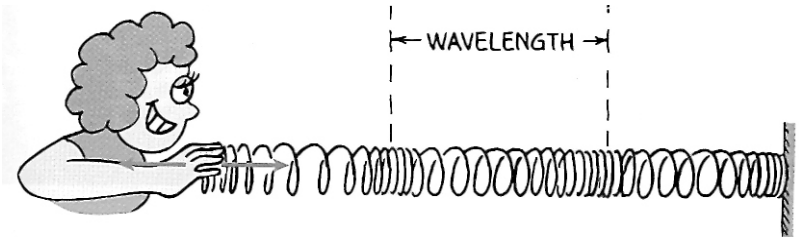
I: Waves

1. Which of the following represents 1 wavelength for the given wave?



A) b-d
B) a-e
C) a-d
D) b-f

2. What type of wave is represented by the following picture?



A) transverse
B) longitudinal
C) light
D) electromagnetic

3. As Ginny skips rope, she counts 38 skips in 20 seconds. What is the period of her skipping rope?

A) 0.53 s
B) 1.9 s
C) 1.9 Hz
D) 760 Hz

4. The frequency of green light is $6x10^{14}$ Hz. What is the wavelength of green light?

A) 5 cm
B) 5×10^{-9} m
C) 0.5 m
D) 500 nm

5. Which of the following does **not** change as a wave travels from one medium to another?

A) wavelength
B) direction of motion
C) frequency
D) velocity

6. The pulses below are traveling toward each other. As they pass through each other, the result will be

A) the amplitude will double.
B) a node.
C) destructive interference.
D) reflection.

7. With respect to 2-D waves, a wavefront

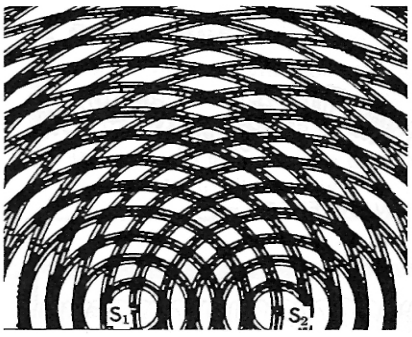
A) is always parallel to the wave ray.
B) represents the direction of motion of a point on the wave.
C) is a series of connected particles moving in phase with one another.
D) always has a circular shape.

8. Which statement is **true** for reflection?

A) The wave passes from one medium to another.
B) There is a change in the velocity of the reflected waves.
C) The wave ray bends towards the normal.
D) The angle of incidence equals the angle of reflection.

9. The diagram below is an example of

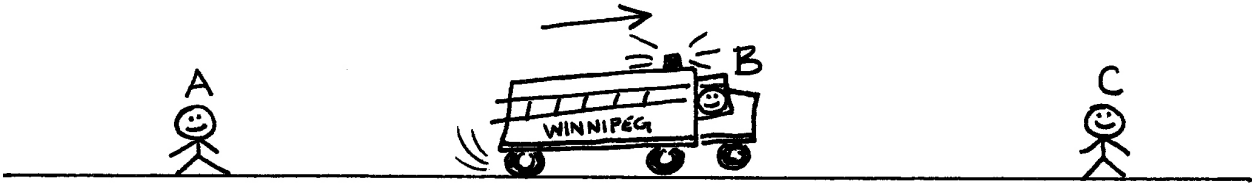
A) diffraction.
B) interference.
C) reflection.
D) rarefaction.



10. Luke is listening to thunder during a storm. If the air outside is 20˚C, how fast does the sound of thunder travel?

A) 100 m/s
B) 331 m/s
C) 1 m/s
D) 343 m/s

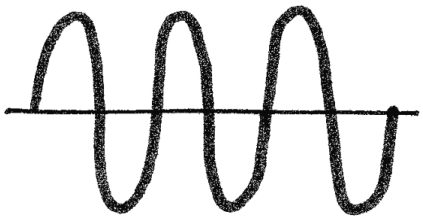
11. The picture below shows a fire truck speeding along a street with the siren on. Which person would hear the lowest pitched frequency?



A) A
B) B
C) C
D) B and C hear the same pitch.

12. Which sound wave represents the lowest frequency and loudest amplitude?

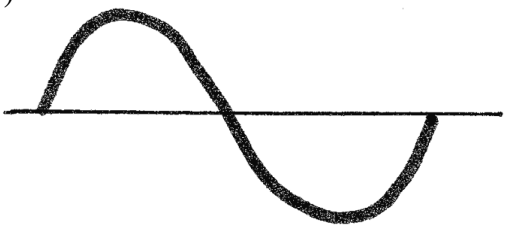
A)



B)

C)

D)



II: The Nature of Light

13. Which mode of representation is being used to show the linear relationship between distance traveled and time for an object moving at constant velocity?

Time (s)	0	10	20	30	40	50
Distance (m)	10	15	20	25	30	35

A) visual
B) numeric
C) symbolic
D) graphical

14. One of the early models of light stated that the eye sends out filaments that 'feel' objects, thus allowing our brains to create a picture of what we see. This theory was known as the

A) wave theory.
B) particle theory.
C) tactile theory.
D) emission theory.

15. Newton's particle theory of light explains dispersion by stating

A) violet particles of light have less mass than red particles, and therefore are more easily deflected when passing through a prism.
B) when particles of light enter a prism, they collide and separate, allowing us to see the full color spectrum.
C) each particle of light has a different color, and some colors are blocked by the glass prism, therefore we only see the ones that pass through.
D) red particles of light travel at a higher speed than violet particles, so they are not so easily deflected when passing through a prism.

16. Determining the speed of light became a critical experiment for the wave and particle theories of light because

A) the wave theory predicted light would move slower in a denser medium, while the particle theory predicted the opposite.
B) the particle theory predicted light would move slower in a denser medium, while the wave theory predicted the opposite.
C) the wave theory assumes the speed of light is instantaneous.
D) rectilinear propagation only works if the speed of light is very fast.

17. Which of the following scientists did **not** measure the speed of light?

A) Galileo
B) Newton
C) Fizeau
D) Michelson & Morley

18. The particle theory of light was weak in explaining some of the observed phenomena of light. One example is the 'theory of fits', which was an attempt to explain

A) reflection.
B) diffraction.
C) dispersion.
D) partial reflection/ refraction.

19. In Young's double slit experiment, the bright fringes on the screen can be spread apart by

A) moving the screen closer the slits.
B) increasing the space between the slits.
C) increasing the wavelength of light used.
D) none of the above.

20. Einstein's experiment on the photoelectric effect showed that electrons can be emitted from a metal surface when light shines on it. Which of the following statements is **true** regarding this effect?

A) As the frequency of the light increases, both the number of electrons emitted and their energy increase.
B) The energy of emitted electrons depends on the frequency of light alone, the intensity of light controls the number of electrons emitted.
C) As the intensity of light increases, both the number of electrons emitted and their energy increase.
D) Electrons are emitted from metal with a higher energy when the light intensity is increased.

III: Mechanics

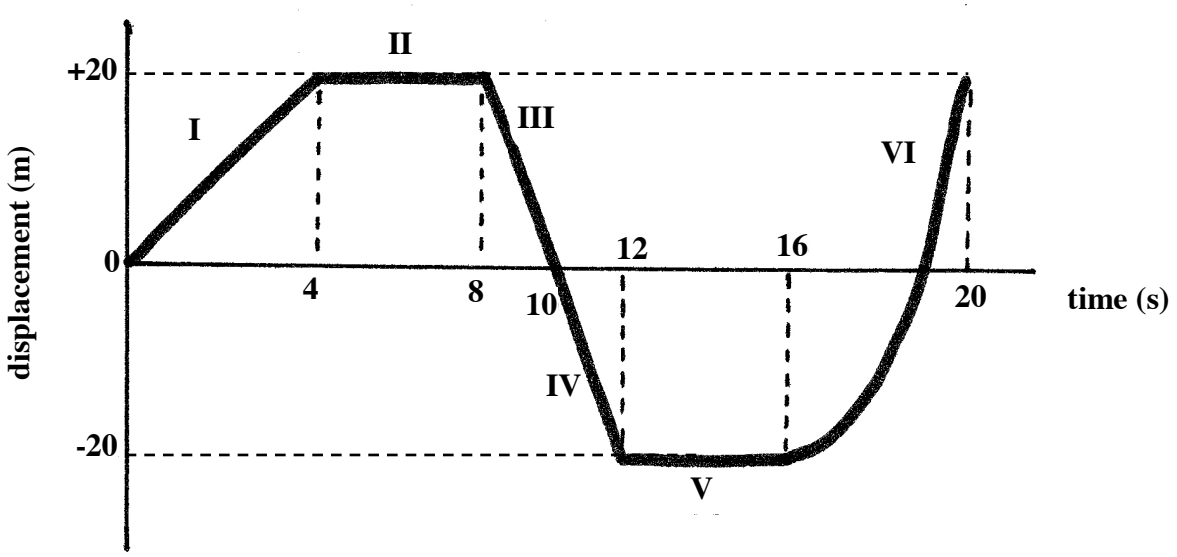
21. Which of the following is a scalar quantity?

A) time
B) velocity
C) electric field
D) force of friction

22. When Arthur walks home from school, he goes 5 blocks east and 6 blocks north. What is his displacement?

A) 7.8 blocks 30º W of N
B) 11 blocks 30º N of W
C) 7.8 blocks 50º N of E
D) 11 blocks 50º E of N

Use the following graph, which represents a student walking in a hallway, to answer questions 23 to 25.



23. During which interval(s) of time was the student moving backward?

A) III only
B) IV only
C) IV, V, and VI
D) III and IV

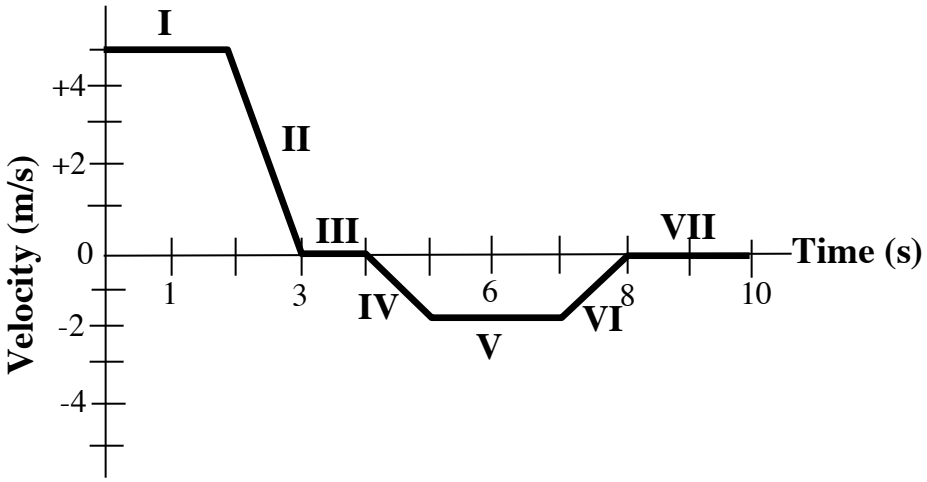
24. What is the student's displacement at the end of 20 s?

A) 20 m forward
B) 300 m forward
C) 100 m forward
D) 0 m

25. What is the average **speed** of the student?

A) 20 m/s forward
B) 5 m/s
C) 1 m/s forward
D) 1 m/s

The following graph represents a car driving in a parking lot. (Questions 26 and 27)



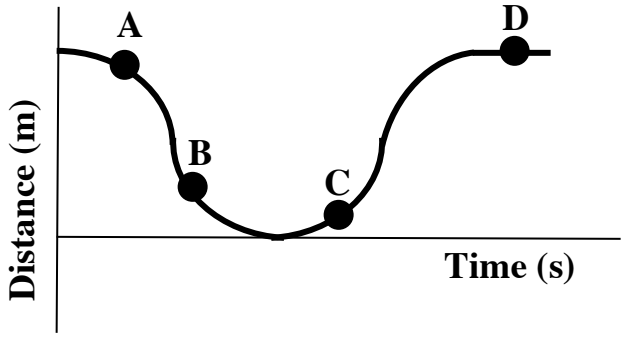
26. During which interval(s) is the car at rest?

A) I
B) III
C) III and VII
D) I, III, V, and VII

27. What is the car's displacement from 0 – 4 s?

A) 1.7 m backwards
B) 12.5 m forwards
C) 5 m forwards
D) 4.2 m forwards

28. For the following graph, at which point is the instantaneous speed the lowest?



A) A
B) B
C) C
D) D

29. A space shuttle turns on its thrusters and accelerates at 17 m/s^2 for 6 seconds. If its initial velocity was 140 m/s, what is the magnitude of its final velocity?

A) 396 m/s
B) 242 m/s
C) 857 m/s
D) 102 m/s

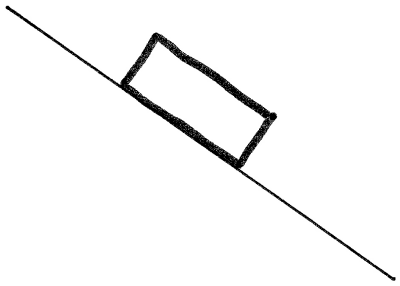
30. A runaway wagon starts rolling down a hill at 0.5 m/s. It accelerates for 3.2 s until it hits a wall 24 m from the top of the hill. How fast was the wagon going when it hit the wall?

A) 14.5 m/s
B) 15.7 m/s
C) 77.3 m/s
D) 76.8 m/s

31. Which of the following is a fundamental force of nature?

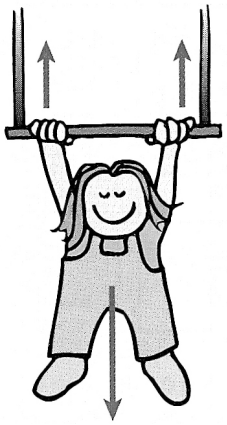
A) strong nuclear force
B) friction
C) applied force
D) normal force

32. An object rests on an inclined plane as shown. Which of the following is **true**?



A) F_{gx} is greater than the force of friction.
B) F_{gy} and the normal force are equal and opposite.
C) The normal force is parallel to the surface.
D) The normal force and friction are equal and opposite.

33. Which of the statements is **true** regarding the picture below?



A) The net force is up.
B) The tension in each string is equal to the girl's weight.
C) The tension is each string is half the girl's weight.
D) The net force is down.

34. A horse pulls a 1000 kg cart with a force of 1800 N. A 200 N force of friction opposes the motion. What is the acceleration of the cart?

A) 1.0 m/s^2 forward
B) 0.2 m/s^2 forward
C) 1.8 m/s^2 forward
D) 1.6 m/s^2 forward

35. Monique is pulling Marcel in a toboggan with a rope at an angle of 40° up from the horizontal. If the combined mass of Marcel and the toboggan is 85 kg and it accelerates at 0.5 m/s^2, what magnitude of force is Monique exerting on the toboggan? (Ignore friction.)

A) 32.5 N
B) 42.5 N
C) 27.3 N
D) 55.5 N

IV: Fields

36. An astronomer on the moon drops a pebble that takes 2.2 s to hit the ground. If g on the moon is 1.62 N/kg, how fast is it going when it hits the ground?

A) 3.6 m/s
B) 1.4 m/s
C) 22 m/s
D) 2.2 m/s

37. Jack (73 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) 715 N
B) 95 N
C) 621 N
D) 810 N

38. Terminal velocity occurs when

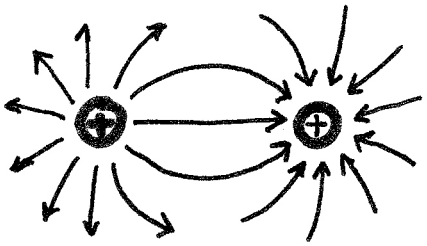
A) an object is in a vacuum.
B) air resistance and the force of gravity are equal.
C) the force of gravity is the only force acting on a falling object.
D) any time an object is in freefall.

39. In regards to friction, which of the following is **true**?

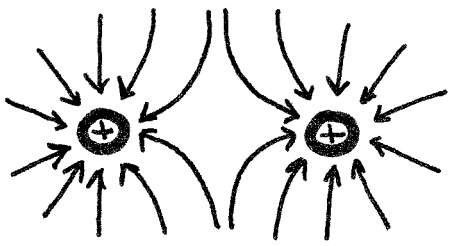
A) The static coefficient of friction is always less than the kinetic coefficient for the same materials.
B) The force of friction on an object depends on the areas in contact between the 2 surfaces.
C) The force of friction on an object changes as the object moves faster.
D) As the normal force increases, the force of friction on an object increases.

40. Which of the following correctly shows the electric field lines around 2 positive charges?

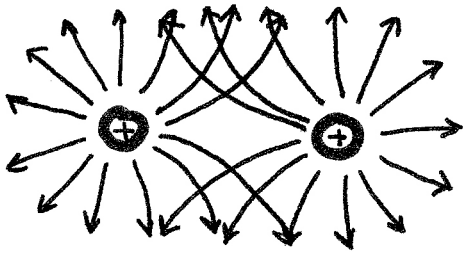
A)



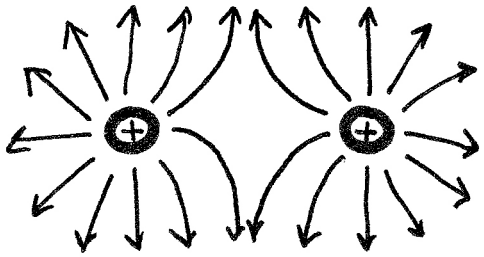
B)



C)



D)



41. An electron experiences of force of $3x10^{-16}$ N to the right. What is the magnitude and direction of the electric field at this point?

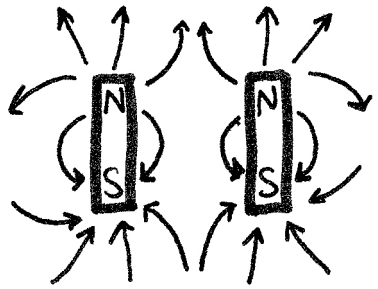
A) 1250 N/C left
B) 1250 N/C right
C) 1875 N/C left
D) 1875 N/C right

42. An oil drop experiences an electric force of $5.6x10^{-16}$ N up in a uniform electric field of 1620 N/C down. What is the charge on the drop in **elementary charges**?

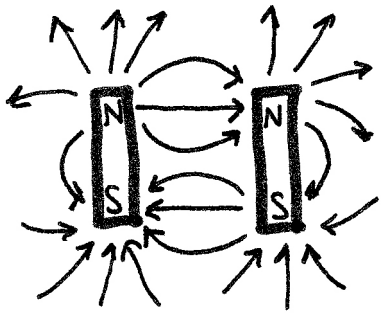
A) $-3.5x10^{-19}$ C
B) $3.5x10^{-19}$ C
C) -2 e
D) 2 e

43. Which of the following correctly shows the magnetic field lines around the magnet configuration?

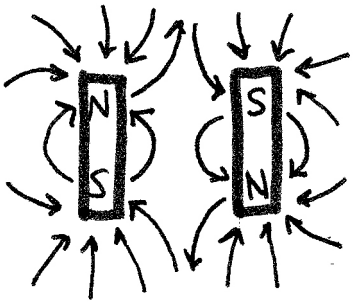
A)



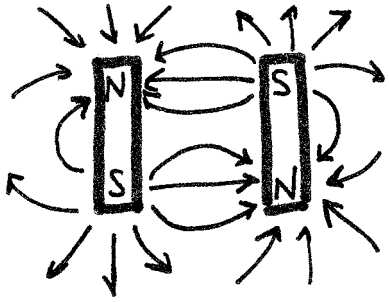
B)



C)



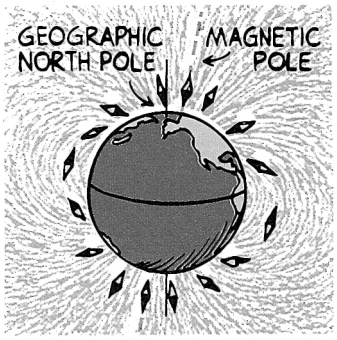
D)



44. With regards to the domain theory, which of the following is **not** correct?

A) All materials are made of domains.
B) Domains can be misaligned by cooling a magnet.
C) Domains can be misaligned by repeatedly dropping a magnet on the floor.
D) A magnet is created when all the domains in a material are aligned.

45. The following diagram shows the position of compass needles at various points around the Earth. This is referred to as the



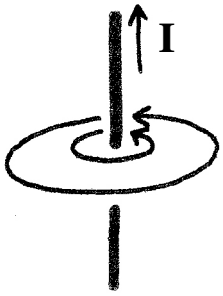
A) angle of declination.
B) angle of inclination.
C) angle of degradation.
D) domains.

46. If you were in Vancouver, British Columbia, the needle of your compass would point

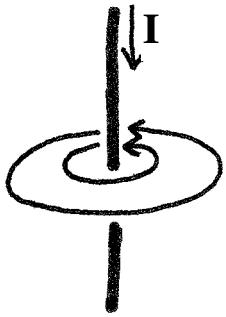
A) to the south geographic pole.
B) west of the north geographic pole.
C) east of the north geographic pole.
D) straight to the north geographic pole.

47. Which of the following diagrams correctly shows the magnetic field around a current carrying wire?

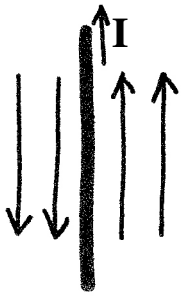
A)



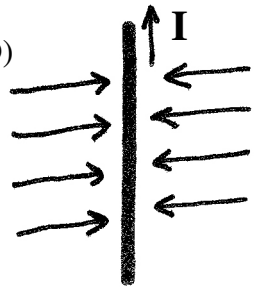
B)



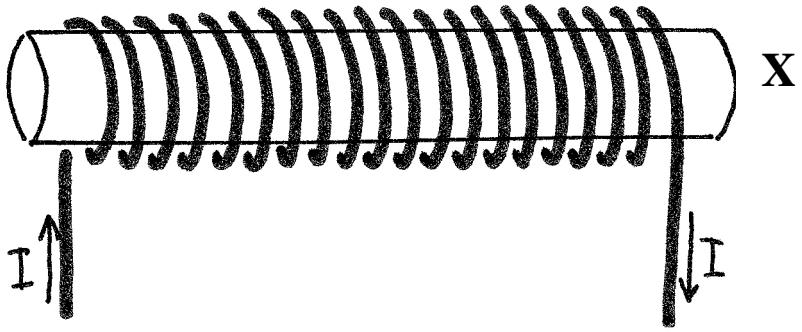
C)



D)

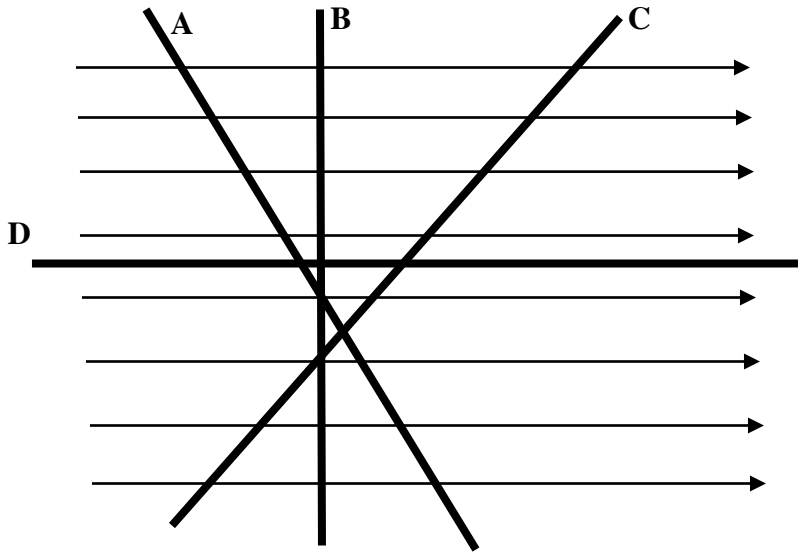


48. When an iron rod is placed in a current carrying solenoid as shown, it becomes a magnet. Which pole exists on the end of the rod marked with an X?



A) The magnetic field here is zero.
B) Only an electric field can be detected.
C) South
D) North

49. Which of the following wires will experience the smallest magnetic force when placed in the magnetic field as shown? (all wires carry the same current)



A) A
B) B
C) C
D) D

50. A 2.5 m wire carrying a current of 6 A into the page, is placed in a magnetic field of 10T, East. What is the force on the wire?

A) 150 N North
B) 150 N South
C) 0.67 N South
D) 0.67 N North