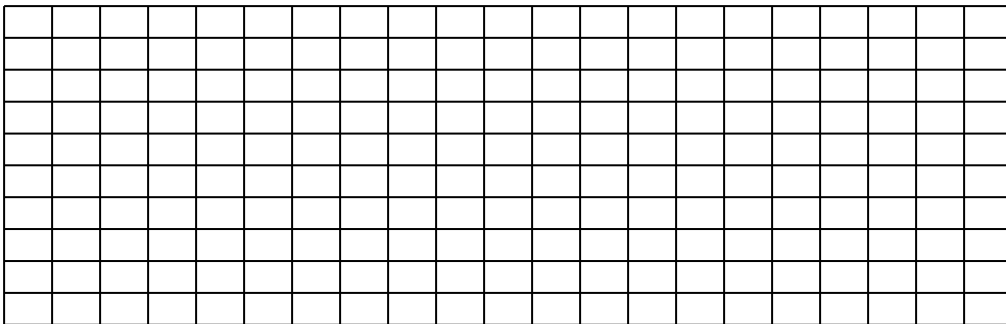# Physics 30S Exam Review

Sample Extended Answer Questions

I: Waves

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

    - wavelength of 8 cm
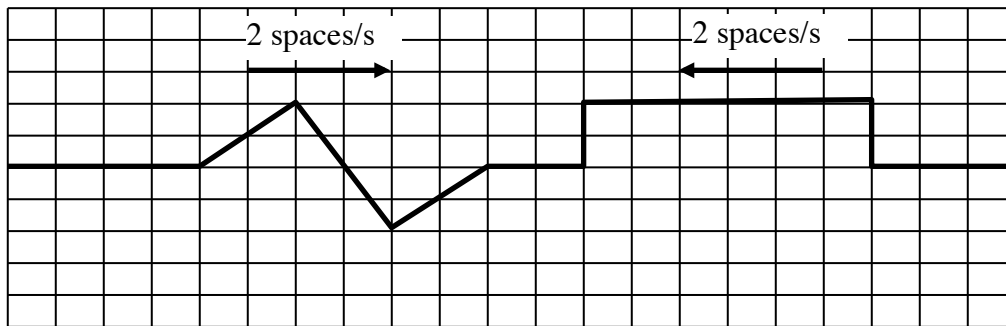   - amplitude of 3 cm

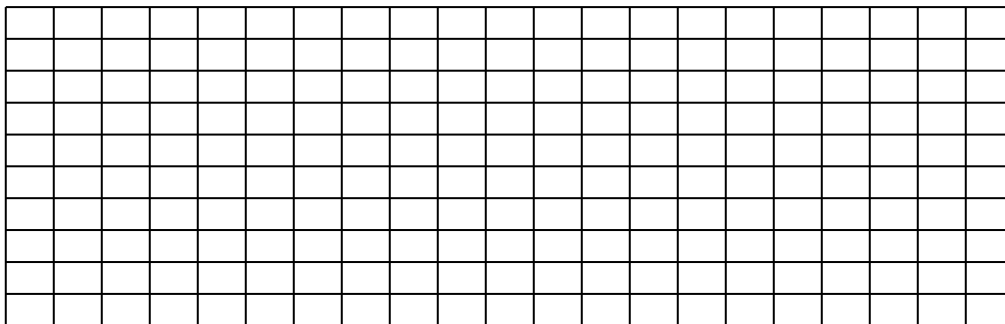2. Jerry is sitting in his fishing boat. He counts 12 waves go by in 10 seconds.

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

    b) If Jerry estimates the wavelength to be 1.25 m, what is the speed of the waves?
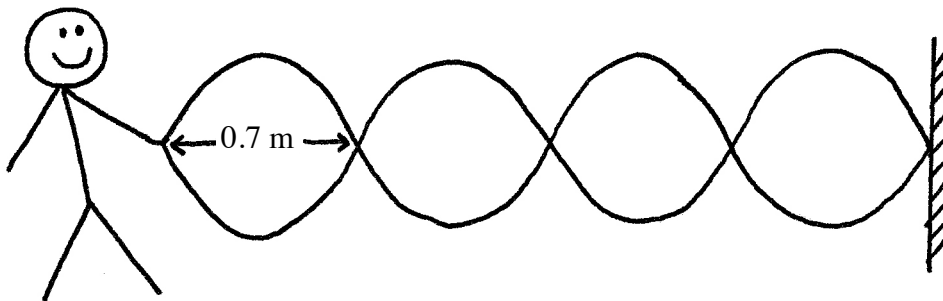
3. The waves, shown below, are moving toward each other at a rate of 2 spaces per second. Sketch the resultant wave pattern after 3 s.

2 spaces/s   2 spaces/s

t = 3 s

4. A student makes a standing wave pattern with a skipping rope as shown. If the waves are moving at 9 m/s, with what frequency does the student move her hand up and down?

0.7 m

5. The light from an aquarium bulb travels from water (n = 1.33) to glass (n = 1.58).

   a) If a ray of light strikes the glass at an angle of 15°, at what angle will it be refracted?

   b) Calculate the speed of light in the glass.

II: The Nature of Light

1. Briefly describe how both the particle and wave models of light can adequately explain the principle of reflection. A labelled diagram may be used in your response.

2. Briefly describe how the particle and wave models of light differ in their explanation of refraction.

3. Max is performing Young's Double Slit Experiment by shining light through two narrow openings 40 µm apart. He measures the distance between the central and fourth bright spots to be 6.9 cm on the screen 2 m away.
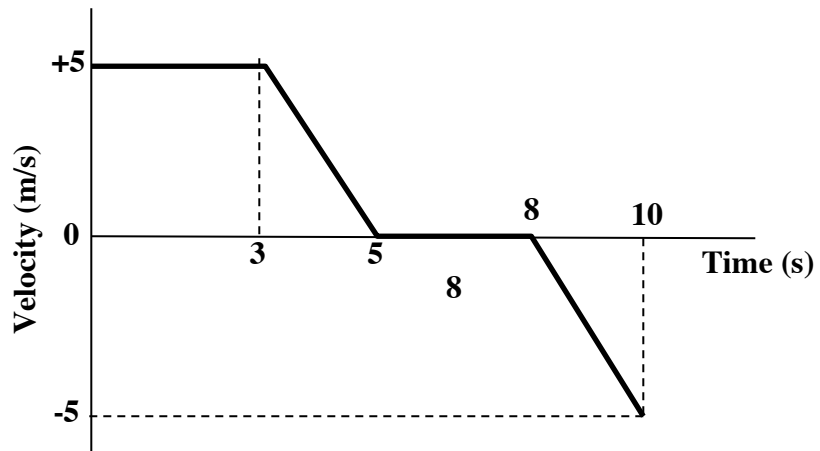
   a) What is the distance between consecutive bright spots on the screen?

   b) What wavelength of light did Max use?

   c) If the distance between the slits increases, 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. You may assume the object starts at the origin.
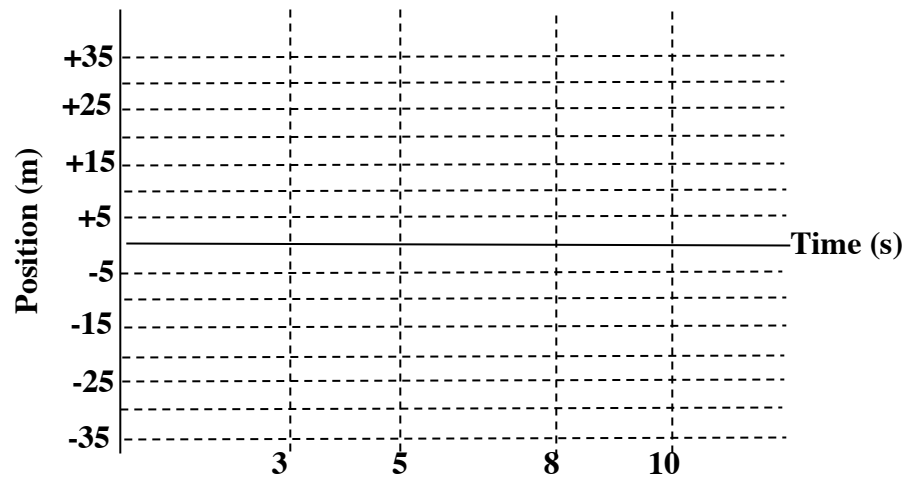
2. Jenny goes for a ride on a waterslide. She starts at 1 m/s and accelerates at 2.3 m/s² all the way down.

   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?

3. Three dogs are pulling on a doggie toy. Great Dane pulls with a force of 75 N to the North, Boxer pulls with a force of 55 N East, and Beagle pulls with a force of 35 N West.

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

   b) Determine the net force acting on the toy.

4. Bobby is pulling his little brother Ralph on a toboggan (total mass = 27 kg) along a horizontal surface. He pulls with a force of 62 N at an angle of 35˚ from the horizontal. A frictional force of 48 N acts between the toboggan and the snow.

   a) Calculate the net force acting on Ralph.

   b) Determine Ralph's acceleration.

IV: Fields

1. An 80 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 downward at 1.4 m/s^2?

2. A 450 kg car is traveling at a constant velocity along a horizontal highway.
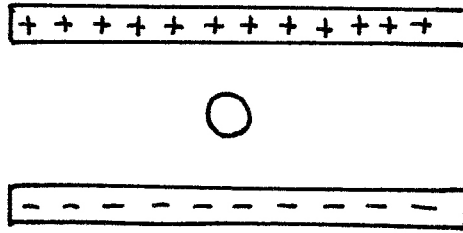
    a) If the motor provides a 900 N force to keep the car moving forwards, what is the frictional force on the car?

    b) What is the coefficient of kinetic friction between the car and the road?

    c) Would you expect the value obtained in part b to be greater or less than the coefficient of **static** friction between the car and the road? Explain.

3. An oil drop of mass 1.96×10^{-15} kg is suspended (not moving) between two parallel plates creating an electric field of 24 000 N/C down as shown.

a) Draw the force vectors acting on the drop.

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┌─────────────────────────────┐
│ + + + + + + + + + + ++ + │
└─────────────────────────────┘

              ○

┌─────────────────────────────┐
│ -  - -   -   -  -   - - - - │
└─────────────────────────────┘
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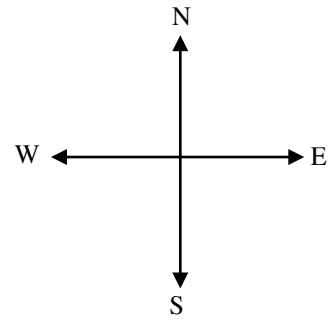
b) Is the charge on the oil drop positive or negative?

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

d) How many excess/deficit elementary charges are on the oil drop?

4. An 8 m length of current carrying wire is placed in a magnetic field of 0.4 T West. If the wire experiences a force of 8.3 N into the page, what is the **magnitude and direction** of the current in the wire?
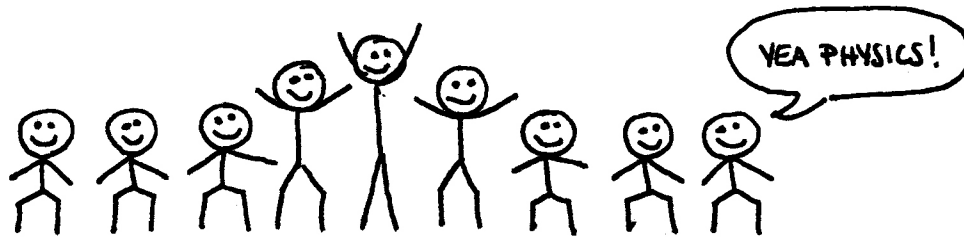
N

W ← → E

S

Sample Multiple Choice Questions

I: Waves

1. Which of the following represents 1 wavelength for the given wave?
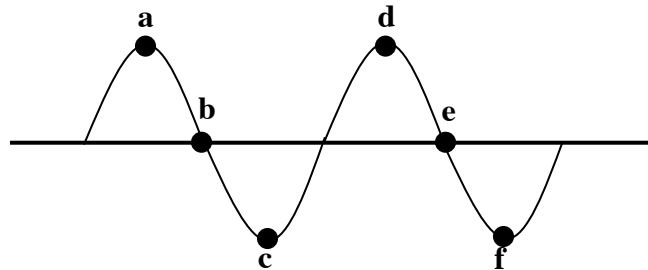
   A) b-d   B) b-e

   C) a-c   D) b-f

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

   A) transverse   B) longitudinal

   C) sound   D) electromagnetic

3. Ginny takes her pulse and counts 40 beats in 30 seconds. What is the period of her pulse?

   A) 0.75 s   B) 1.3 s

   C) 1.3 Hz   D) 80 Hz

4. Denise checks the back of her microwave and finds the frequency to be 6.0×10^{10} Hz. What is the wavelength of the microwaves?

   A) 5 cm   B) 5 m

   C) 0.5 m   D) 5 mm

5. As a wave travels from one medium to another, its _____ remains the same, while the _____ and _____ change.

   A) wavelength, frequency, velocity
   B) amplitude, wavelength, frequency
   C) frequency, velocity, wavelength
   D) velocity, amplitude, wavelength

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) constructive interference.
   C) destructive interference.
   D) reflection.

7. Which statement for 2-D waves is correct?

   A) A waveray is a series of connected particles moving in phase with one another.
   B) A waveray represents the direction of motion of a point of the wavefront.
   C) The direction of motion of the waveray is parallel to the wavefront at that point.
   D) A wavefront in a ripple tank always has a circular shape.

8. Which statement is **true** for **both** reflection and refraction?

   A) The angle of incidence equals the angle of reflection/ refraction.
   B) There is a change in the velocity of the waves.
   C) The wave ray bends towards the normal.
   D) The wave ray changes direction.

9. The diagram below is an example of
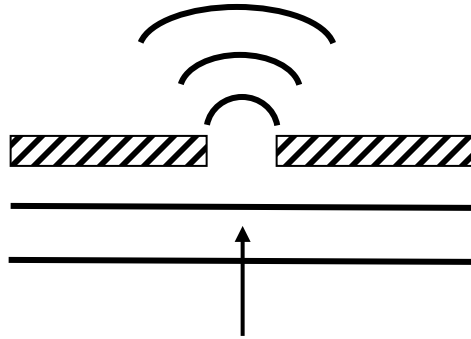
A) diffraction.
B) refraction.
C) reflection.
D) rarefaction.

10. Rudy is listening to thunder during a storm. If the air outside is 13°C, how fast does the sound of thunder travel?

A) 100 m/s
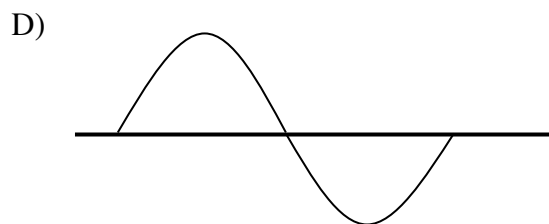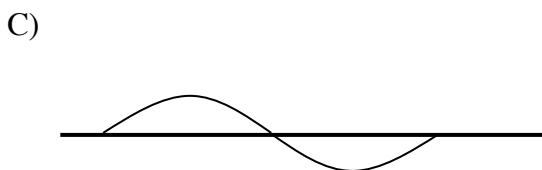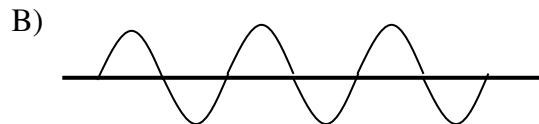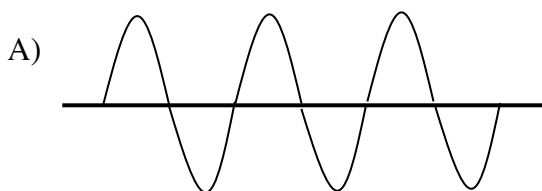B) 39 m/s
C) 1 m/s
D) 339 m/s

11. The picture below shows a fire truck speeding along a street with the siren on. Which person would hear the highest pitched frequency?
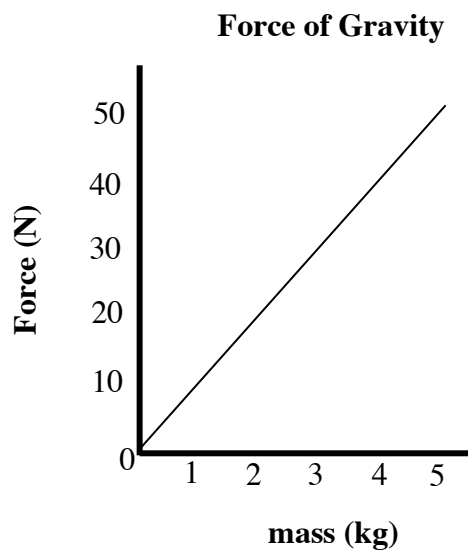
A) A
B) B
C) C
D) B and C hear the same pitch.

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

A)

B)

C)

D)

II: The Nature of Light

13. Which of the following **best** represents the relationship between mass and the force of gravity as shown on the graph?

Force of Gravity

A) $F_g = mg$ (where g = slope)
B) $F_f = \mu F_N$ (where μ = slope)
C) $F = 2mg$
D) $F = mg\sin\theta$

14. One of the early models of light stated that objects send out light beams or particles that ricochet off objects and enter the eye. 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 that particles of light travel in a straight line because

   A) air molecules do not allow them to turn.
   B) it is the shortest distance between 2 points.
   C) they fall to Earth due to gravity.
   D) they are traveling very fast.

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

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

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

   A) Roemer   B) Fizeau
   C) Focault   D) Kepler

18. The particle theory of light was weak in explaining

   A) reflection.   B) refraction.
   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 further from the slits.
   B) increasing the space between the slits.
   C) decreasing 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) Electrons are emitted from metal with a higher energy when the light intensity is increased.
B) More electrons are emitted from a metal surface when the light intensity is increased, but their energy remains the same.
C) The number of electrons emitted from the metal depends only on the frequency of the light.
D) As the frequency of the light increases, both the number of electrons emitted and their energy increase.

III: Mechanics

21. Which of the following is a scalar quantity?

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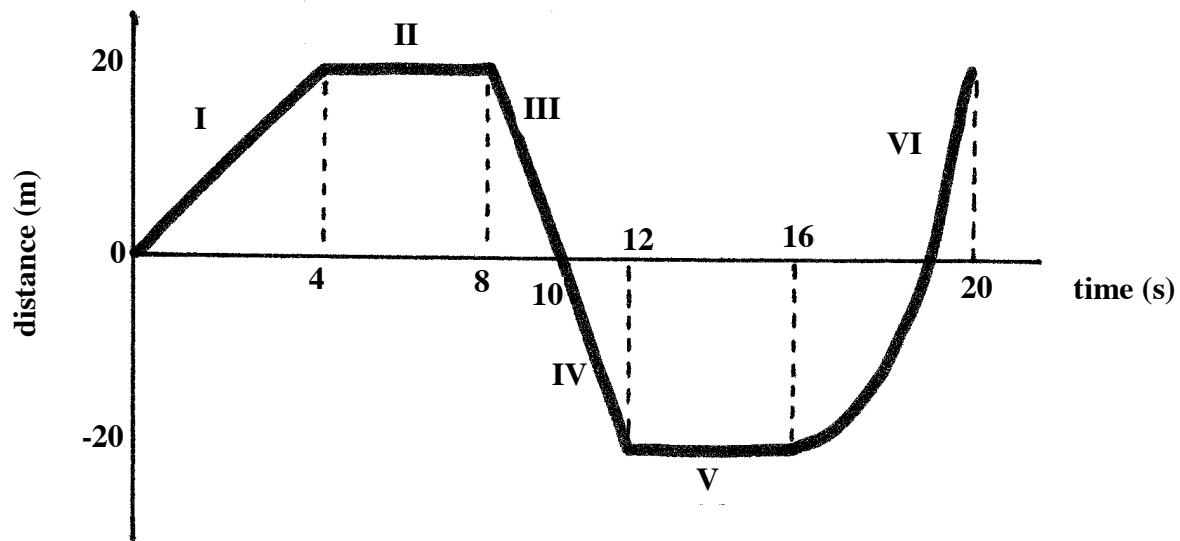C) acceleration   D) force

22. When Jeremy walks home from school, he goes 4 blocks east and 2 blocks south. What is his distance and displacement?

Distance	**Displacement**
A) 4.5 blocks	4.5 blocks 27˚ S of E
B) 6 blocks S of E	0.5 blocks S of E
C) 6 blocks	4.5 blocks 27˚ S of E
D) 4 blocks E 2 blocks S	4.5 blocks S 63˚ E

The following graph represents a student walking in a hallway. (Questions 23 to 25)

23. During which interval of time was the student traveling at a constant velocity forward?

A) I   B) VI

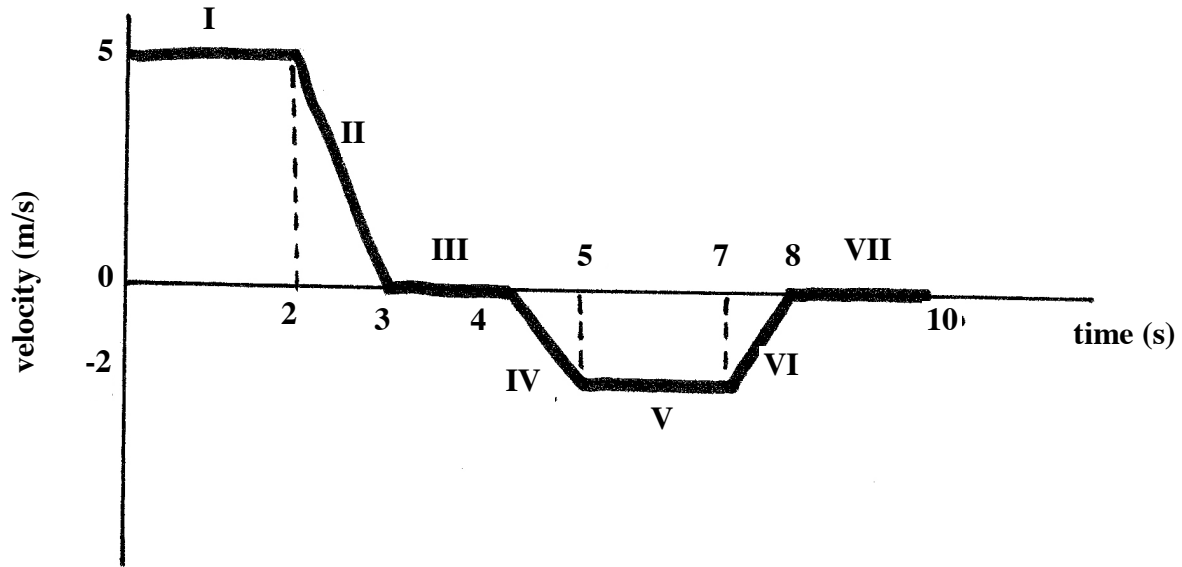C) II   D) I and III

24. What is the student's average velocity over the entire interval?

A) 20 m/s forward   B) 5 m/s forward

C) 1 m/s forward   D) 13.6 m/s forward

25. What is the total distance traveled by the student?

A) 20 m forward   B) 100 m

C) 40 m forward   D) 80 m

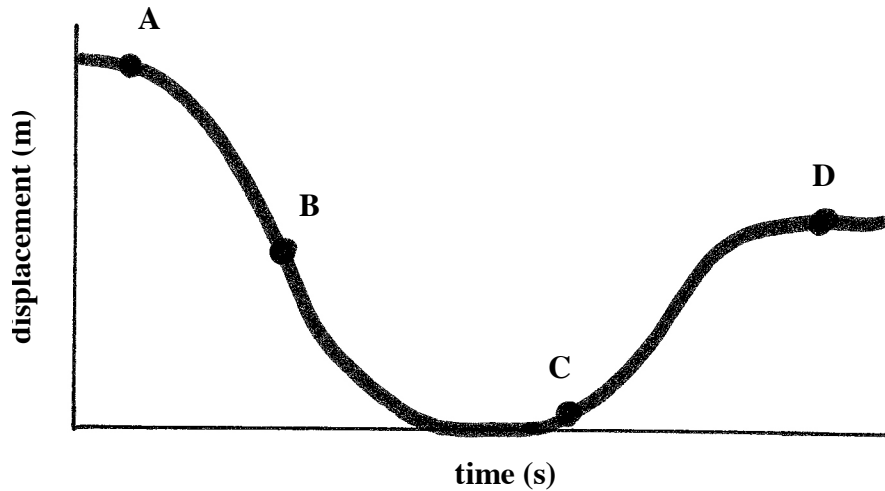**The following graph represents a car driving in a parking lot. (Questions 26 and 27)**

26. During which interval is the car increasing in speed?

    A) I   B) VI
    C) II   D) IV

27. What is the car's displacement from 0 – 3 s?

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

28. For the following displacement-time graph, at which point is the instantaneous speed the greatest?

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

29. A space shuttle turns on its thrusters and accelerates at +20.5 m/s² for 9 seconds. If its initial velocity was +160 m/s, what is the magnitude of its final velocity?

A) +345 m/s
C) +18 m/s

B) +16 m/s
D) +362 m/s

30. 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?
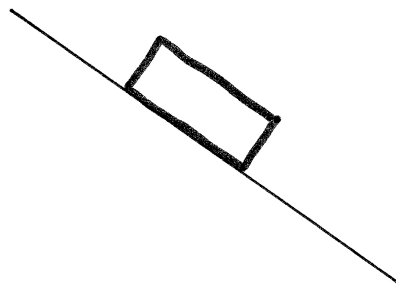
A) 14 m/s
C) 16 m/s

B) 25 m/s
D) 170 m/s

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

A) strong nuclear force
C) gravitational force

B) friction
D) electromagnetic force

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

A) F_g and the normal force are equal and opposite.
B) F_g and friction are equal and opposite.
C) The normal force and friction are equal and opposite.
D) The normal force is perpendicular to the surface.

33. Four sisters are fighting over a pair of jeans, and each one is pulling them in a different direction. Calculate the net force on the jeans.

30 N

25 N ← → **30 N**

30 N
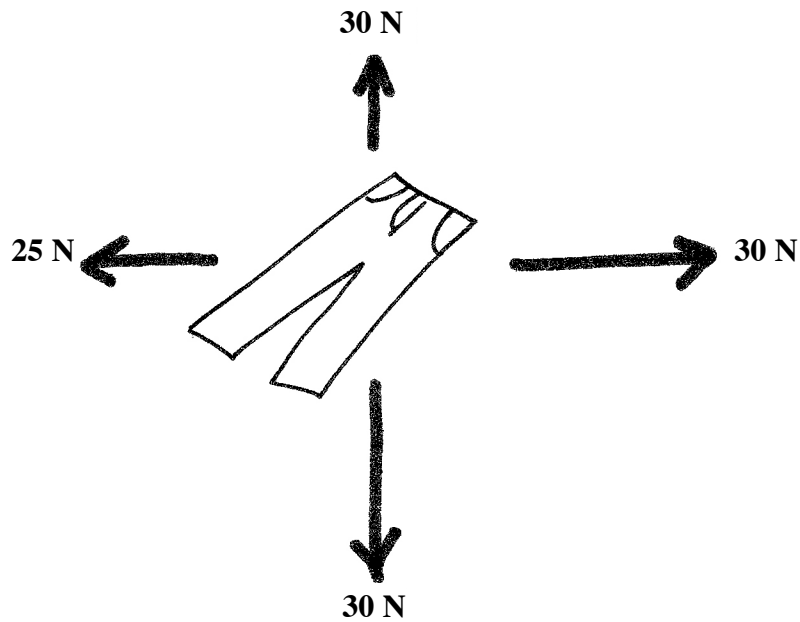
A) 5 N to the right
C) 115 N to the right

B) 5 N to the left
D) 115 N to the left

34. A horse pulls a 1200 kg cart with a force of 2000 N. A 200 N force of friction opposes the motion. What is the acceleration of the cart?

A) 216 m/s^2 forward
C) 1.5 m/s^2 forward

B) 240 m/s^2 forward
D) 1.7 m/s^2 forward

35. Karina pushes on a 60 kg shopping cart at an angle of 35° as shown. If the cart accelerates at 0.4 m/s^2, what magnitude of force is Karina exerting on the cart? (Ignore friction.)

35°
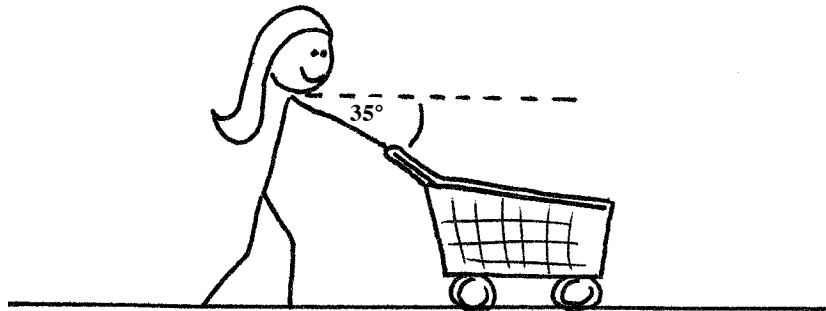
A) 24 N
C) 20 N

B) 29 N
D) 14 N

IV: Fields

36. 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

37. 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

38. Terminal velocity occurs when

A) an object is accelerating at -9.8 m/s^2.
B) there is no air resistance.
C) the forces acting on a falling object are balanced.
D) an object is orbiting the Earth.

39. In regards to friction, which of the following 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 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 decreases.

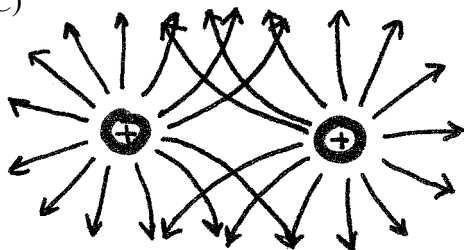40. Which of the following correctly shows the electric field lines around 2 positive charges?
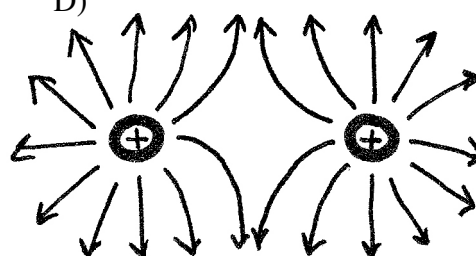
A)
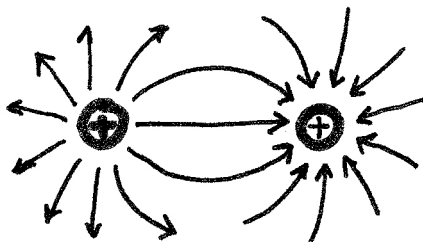
B)
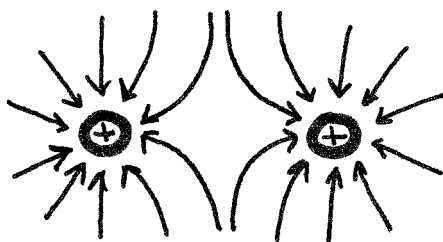
C)

D)

41. An electron experiences of force of $2x10^{-16}$ 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

42. An oil drop experiences an electric force of $3.4x10^{-16}$ N up in a uniform electric field of 420 N/C down. How many excess/deficit elementary charges are in the oil drop?

A) -8.75 x 10^{-5} e
B) +8.75 x 10^5 e
C) -5 e
D) +5 e

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

A)

B)

C)

D)
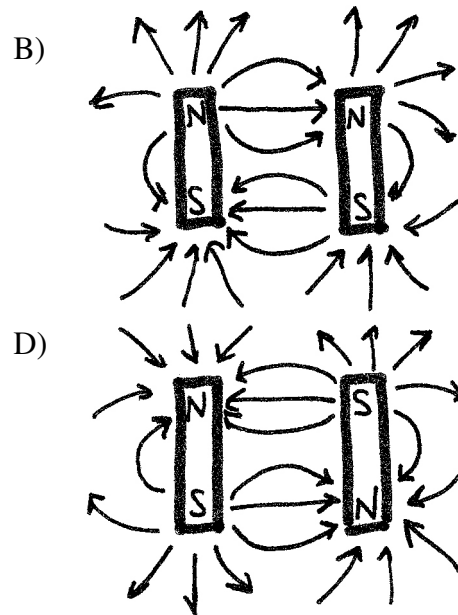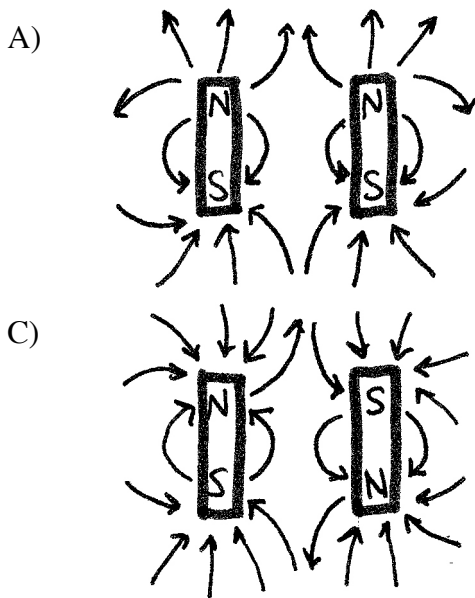
44. With regards to the domain theory, which of the following is correct?

A) Only magnetic 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) When the domains in a magnet are randomized, they can never be aligned again.

45. The following diagram represents

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

46. If you were in Newfoundland, 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)

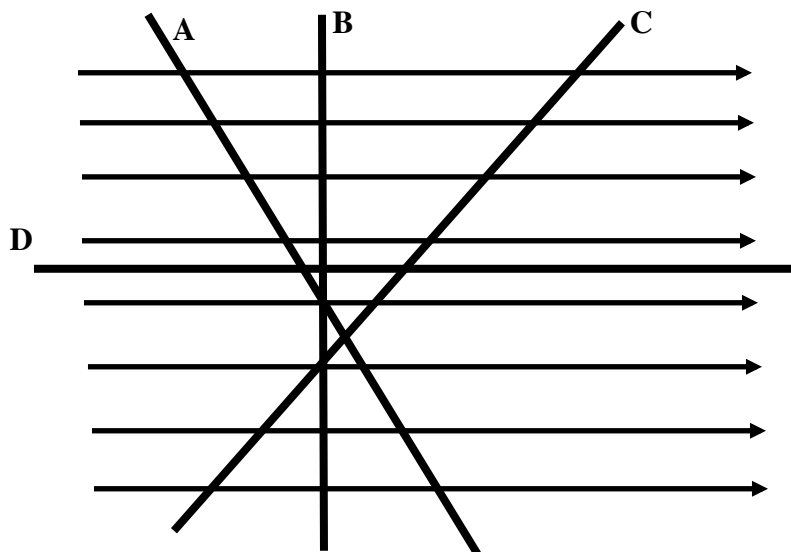
C)

D)
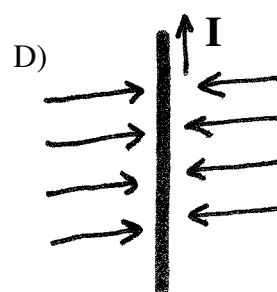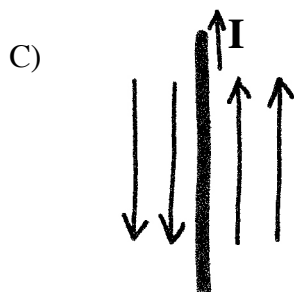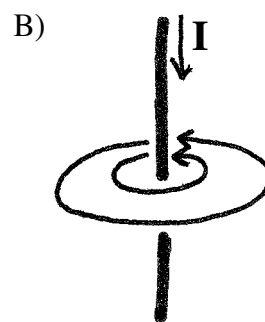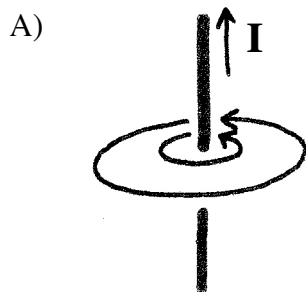
48. For the solenoid shown below, what is the direction of the magnetic field at the point given?
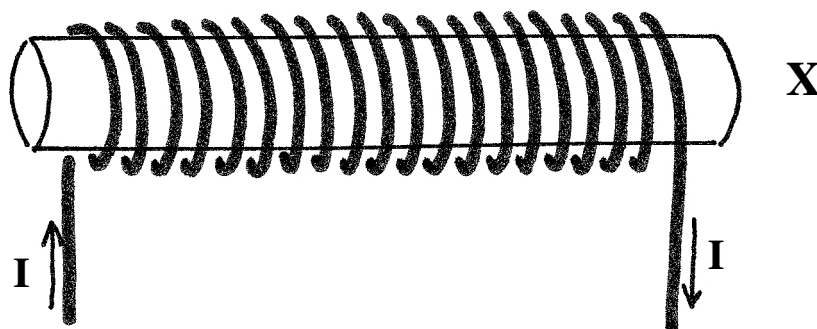
A) into the page   B) out of the page
C) left   D) right

49. Which of the following wires will experience the greatest 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 1.5 m wire carrying a current of 3 A west is placed in a magnetic field 4 T out of the page. What is the force on the wire?

A) 0.9 N North   B) 0.9 N out of the page
C) 18 N South   D) 18 N North