Memorial University of Newfoundland

Physics 1021

Final Examination   Name_____

April 19, 2006   MUN NO._____

Time 2 Hours

INSTRUCTIONS:

1.   There are three parts to the exam. **ANSWER ALL QUESTIONS FROM PART A and PART B and 1 out of two from part C.**

2.   Questions from part A are 2 marks each (Total 20). Questions from parts B and C are 10 marks each (Total 80)

3.   Please use **THREE** significant figures in all calculations.

4.   **Relax!** Good luck!

A	1	2	3	4	5	6	7	8	9	Total

Part A(Total 20 Marks)

1. A simple Harmonic oscillator with amplitude A has a period of 4.00 seconds. It is released from x=A at t=0 s. At t=20.0 s the oscillator is at:
   a. x=0 m
   b. x=A
   c. x= - A
   d. x=A/2

2. If the displacement of a simple harmonic oscillator is described by the function $x(t) = .24Cos(2\pi t)$ The oscillator is at x=.10 m at time:
   a. 0.18 s
   b. 10.4 s
   c. 5.0 s
   d. 0.56 s

3. An object floats in water so that 2/3 of it is submerged. The density of the object is:
   a. 667 kg/m^3
   b. 1500 kg/m^3
   c. 333 kg/m^3
   d. 1000 kg/m^3

4. A string fixed at both ends is oscillating in its third harmonic. Along the length of the string there are
    a. one antinode
    b. two antinodes
    c. three antinodes
    d. four antinode

5. A source (S) and an observer (O) are moving in the same direction with the source following the observer. Put the correct signs into the Doppler equation.

$$f' = (\frac{1 \frac{u_0}{v}}{1 \frac{u_S}{v}})f_0$$

6. Two charges of equal magnitude, one positive and the other negative, are at the same position in an electric field. The charges:
    a. are at the same potential and have the same potential energy
    b. are at the same potential and have different potential energies
    c. are at different potentials and have the same potential energy
    d. are at different potentials and have different potential energies

7. A boy sits near two speakers both emitting sound of the wavelength 3.0 m . The boy is 6.0 m from one speaker and 12.0 m from the other. The boy hears :
    a.   a loud sound
    b.   no sound
    c.   a sound which is changing in pitch
    d.   a different sound in each ear

8. A magnetic field is directed into the page, as shown. A negatively charged particle is moving in the +x direction through the field. The magnetic force on the particle is directed :
   a. in the +x direction
    b. in the -x direction
    c. in the +y direction
    d. in the -y direction
    e. into the paper
    f. out of the paper
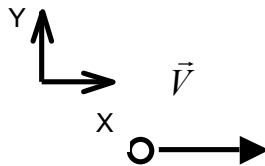
9. The total electric field $\vec{E}_T$ due to two point charges q_1 and q_2 is shown in the picture, along with the electric field $\vec{E}_1$ due to q_1. If the charges have the same magnitude, it must be true that:
    a. q_1 and q_2 are positive
    b. q_1 is positive and q_2 is negative
    c. q_1 is negative and q_2 is positive
    d. q_1 and q_2 are negative
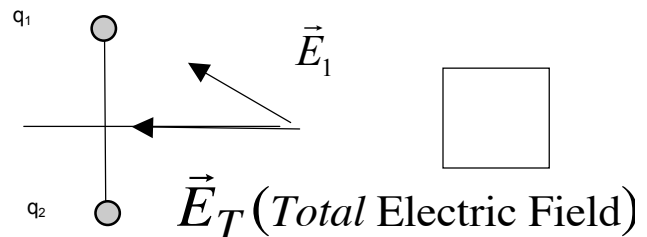
10. If the radius of a wire is doubled and the length is doubled then the resistance of the wire is:
    a. doubled
    b. halved
    c. increased by four times
    d. increased by eight times
    e. unchanged

PART B- Do all 7 questions in this section

1. A Simple Harmonic Oscillator consisting of a 305 g mass and a spring is set oscillating on a smooth flat surface. If the maximum speed of the mass is 1.50 m/s and the spring constant of the spring is 2.00 N/m, determine:
    a. the period of the motion
    b. the amplitude of the motion
   c. the x position when the speed is 1.20 m/s

2.

a. Why do we use the Decibel Scale?

b. While walking home one day Physicist Joe encounters his two friends Bill and Laura. Joe is 2.70 m from Bill and 3.50 m from Laura. Joe measures the sound intensity of Bill's voice as 4.50×10^{-5} W/m^2 and the sound intensity level of Laura's voice to be 79.0 dB. Determine:
   i. the sound intensity level that Joe measures for Bill's voice
   ii. the sound intensity Joe measures for Laura's voice
   iii. the sound intensity <u>level</u> that Joe would measure if both friends talked at once.

3.

   a. A 1.0 kg mass is hung from a string which passes over a pulley, as shown. The string between the wall and the pulley has a length of 0.65 m and mass 23.0 g .

      i. What is the fundamental resonance frequency of this length of string?

      ii. If the 1.0 kg mass is replaced by a 2.0 kg mass, by what factor does the fundamental resonance frequency change?


L=0.65m

m=1.0 kg
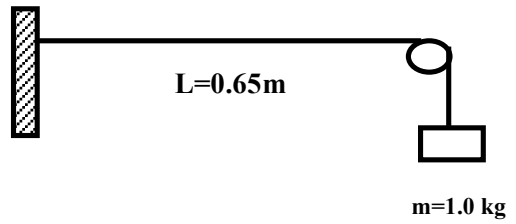
   b. A tuning fork of frequency 429 Hz is placed near the open end of a 1.00 m long tube which is open at one end. The tube resonates. The speed of sound in air is 343 m/s.

      i. Which resonance (harmonic) of the tube is this? What is the fundamental frequency of the tube?

      ii. If the closed end of the tube is now opened, what will be the frequency of the second resonance of the tube?

4.

a. A metal cylinder of radius 1.0 cm and height 20.0 cm has a weight in air
   of 0.507 N.
   i. Show that when it is placed in water it will float.
   ii. What percentage of the cylinder volume will be above the
   water? The volume of a cylinder is $V = \pi r^2 h$
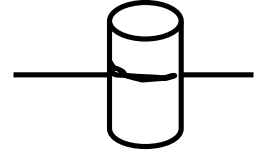
b. In the manometer shown, oil of density 600 kg/m³ partially fills the tube
   of the manometer. If the height of the oil is 41.0 cm, the pressure of the
   gas is 97.0 kPa and atmospheric pressure is 101 kPa, how high will the
   water rise in the tube?
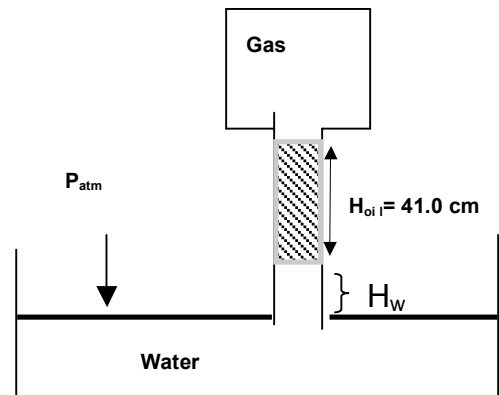
5. A charge of $q_1 = + 5.00 \times 10^{-6}$ C is fixed at $y = + 1.0$ m as shown in the diagram. A second charge $q_2 = - 2.00 \times 10^{-6}$ C is at $y = - 1.00$ m.
   a. Determine the electric potential at the point (2.0,0) m on the x axis.
   b. How much work must be done to bring a charge $q_3 = - 4.00 \times 10^{-6}$ C to this point?
   c. What is the electric potential energy of this new system?

q_1

(2,0)

q_2
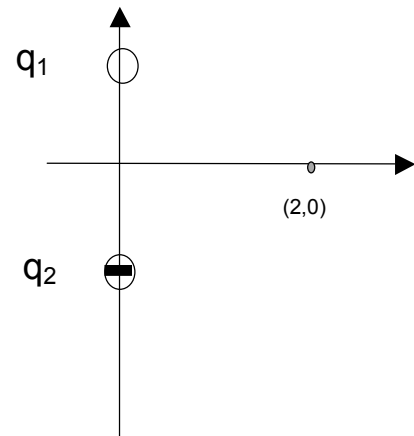
6. A point charge q_1 = -2.00 µC is positioned at (0, 0) m while another charge q_2 = 3.00 µC is located at (3.0, 0) m.
    a. Determine the electric field at (1.00, 0) m.
    b. What is the force on an electron placed at this point?
    c. Indicate on the diagram(NO CALCULATION) where on the x axis the electric field might be zero.

q_1
q_2

(0,0)
(3.0,0)

7.
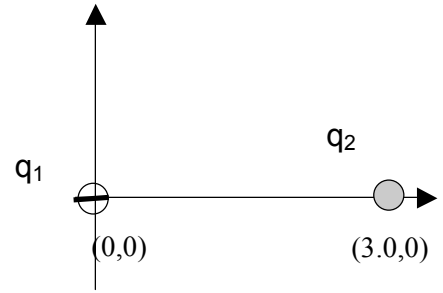
a. If you plot a graph of voltage vs current for an ohmic material, what would you expect to get for the slope and intercept?

b. In the circuit shown, determine:
    a. The equivalent resistance R_{eq}
    b. The power supplied by the battery
   c. the current through the 6Ω resistor

4Ω

12 V

6Ω

3Ω

2Ω
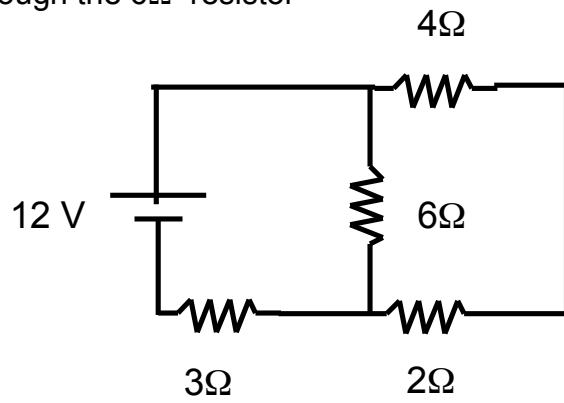
8.

    a.   State the conditions for constructive and destructive interference.

    b.   A hamster stands in a rectangular shaped tunnel . The tunnel is 120.0 cm long and is 80.0 cm wide. A speaker sits in one corner and the hamster is at the end of the corridor , as shown. If the speed of sound is 343 m/s,

         i.   what is the lowest frequency for which the hamster hears no sound?

         ii.   If the speaker is tuned to emit a sound of frequency 1005 Hz, how far must the hamster move to the left if he is to hear no sound?

Speaker

120.0cm

80.0cm

Hamster
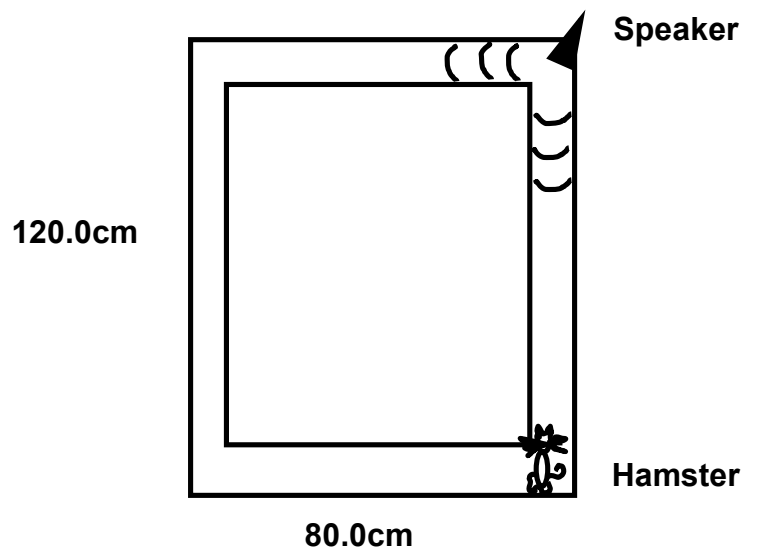
9. Two current carrying wires, each of length 1.0 m and separated by 2.0 m have currents into the page, as shown.
   a. Determine the magnetic field at the point (3.0) m on the x axis.
   b. A charge of q= -2.0x10^{-5} C is injected with a speed of 4.0x10^6 m/s into the page at the point (3.0,0) m. What is the force on the charge?

I_2=30.0 A

(0,2.0)

I_1=20.0 A

(0,0)

(3.0,0)