Memorial University of Newfoundland

Physics 1021

Final Examination   **Name**_____

April 14, 2008   **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.
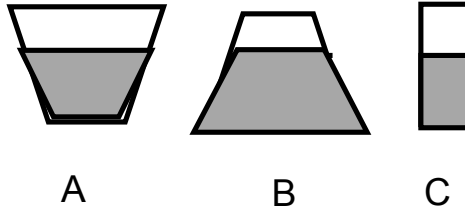
4.   **Relax!** Good luck!

A	1	2	3	4	5	6	7	8	9	Total

Part A(Total 20 Marks)

1. The amplitude of a s system moving with simple harmonic motion is doubled . The total energy is:
    a.   unchanged
    b.   doubled
    c.   halved
    d.   increased by four times

2. If the displacement of a simple harmonic oscillator is described by the function
    $x(t) = 2.0 Cos(4t)$ The maximum speed of the oscillator is:
    a.   2.0 m/s
    b.   4.0 m/s
    c.   0.5 m/s
    d.   8.0 m/s

3. A hydraulic jack consisting of a large piston which has 4 times the diameter of the small pistion is used to lift a car which has a weight of 4800 N. The input force required at the input piston is:
    a.   300 N
    b.   1200 N
    c.   3600 N
    d.   4800 N

4. What would the pressure, in atmospheres, be on a diver be if he could dive to a depth of 1.00 km in seawater? The density of seawater is 1021 kg/m^3 and one atmosphere is 101×10^3 N/m^2.
   a. 100 Atm
   b. 130 Atm
   c. 111 Atm
   d. 9 Atm
   e. 90 Atm

5. The water in each of the three vessels of different shapes has the same height. Rank the forces on the bottoms of the vessels form highest to lowest.
   a. $F_A > F_B > F_C$
   b. $F_C > F_B > F_B$
   c. $F_B > F_A > F_C$
   d. $F_A > F_B = F_C$
   e. $F_A = F_B = F_C$

   A   B   C

6. If the frequency of a wave is doubled, then the wavelength:
   a. is doubled
   b. is halved
   c. is the square root of the initial wavelength
   d. is the reciprocal of the initial wavelength

7. Fred the musician, notices that a particular sound A appears 4 times as loud to him as does sound B. It must be true that the intensity of sound A is:
   a. 4 times the intensity of sound B
   b. 10 times the intensity of sound B
   c. 20times the intensity of sound B
   d. 100 times the intensity of sound B

8. If the length of a current carrying wire is doubled, then it's resistance:
   a. is doubled
   b. is halved
   c. increases by 4 times
   d. decreases by 4 times

9. A magnetic field is directed in the x direction . A positively charged particle is moving in through the field, in the direction shown, 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

   Y

   X

   $\vec{V}$ $\vec{B}$

10. 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

    q₁

    $\vec{E}_1$

    $\vec{E}_T$

    q₂
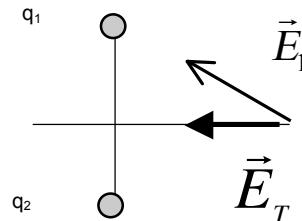
PART B- Do all 7 questions in this section

1.   A 1.0-kg block, attached to a spring of force constant K oscillates with an frequency of 2.0 Hz. The block is released from rest with a displacement of 0.150 m
   a. What is the spring constant of the spring?
   b. What is the maximum speed of the mass?
   c. What are the position and velocity of the block 2.0 seconds after it is released?

x=0
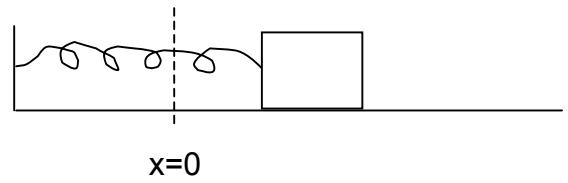
2.   Dr Goulding's Honda snowblower produces a sound level of 84.7 dB at a distance of 2.0 m from the snowblower. Determine:
    i.   the sound intensity I of the snowblower at 2.0 m
    ii.   the power produced by the snowblower
    iii.   the sound level that 4 such snowblowers, parked together would produce at a distance of 5.0 m away.

3.
   a. An ambulance travels down a highway at a speed of 33.5m/s., its siren emitting sound at a frequency 400Hz. What frequency is heard by a passenger in a car traveling with 24.6 m/s in opposite direction as the car and ambulance

      i. *approach* each other
      ii. pass and *move away* from each other.

V_S=343 m/s

   b. A pipe, in air, is 2.46m long.

      i. Determine the frequencies of first two harmonics if the pipe is open at both ends
      ii. What would be the two lowest possible frequencies if the pipe is closed at one end and open at the other?

4.

    a.   A diver in a swimming pool collects rocks from the pool bottom and loads them onto his floating raft. If the diver stays submerged in the pool does the water in the pool rise or fall? Support your answer.

    b.   An empty balloon has a mass or 5.46 g and is then filled with helium so that the radius of the balloon is 10.5 cm.
        i.   What is the weight of the helium in the balloon?
        ii.   What is the buoyant force exerted by the air on the balloon?
        iii.   When released in air, does the balloon rise, sink or remain stationary? Support your answer with calculations.
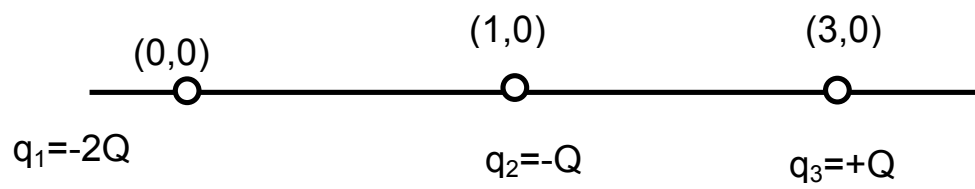
$$\delta_{He} = 0.179 \text{ kg/m}^3 \qquad V = \frac{4}{3}\pi r^3$$

$$\delta_{air} = 1.29 \text{ kg/m}^3$$

5.

a. A positively charged rod is brought near a suspended object. If the object is attracted by the rod what must be the charge of the object? If the object is repelled, can we conclude that the object is charged? Explain.

b. Three point charges are aligned along the x-axis as shown on the figure below $Q=2.0\times10^{-5}C$

	(1,0)	(3,0)
(0,0)		
$q_1=-2Q$	$q_2=-Q$	$q_3=+Q$

i. Find the electric field at the position x=+2.0m, y=0, ie. (2,0)

ii. A charged particle is positioned at this point (2,0) m. Find the force on the particle if its charge is $q_4= -5\mu C$.

6.

a. Bob is at A hardware store and he has a choice of 2 light bulbs .
Lightbulb A has a resistance of 240 ohms and lightbulb B has a
resistance of 1100 ohms? If both lightbulbs give the same
brightness when connected to a 12 V battery, which one should he
choose, that is, which one is the most energy efficient one?
Support your answer. A simple calculation might help.

b. In the circuit shown , V_{ab}=20.0 V. Determine:
   i. The equivalent resistance R_{eq} of the circuit (Hint: Redraw
      this circuit first)
   ii. the current through the 8Ω resistor
   iii. The power supplied by the battery
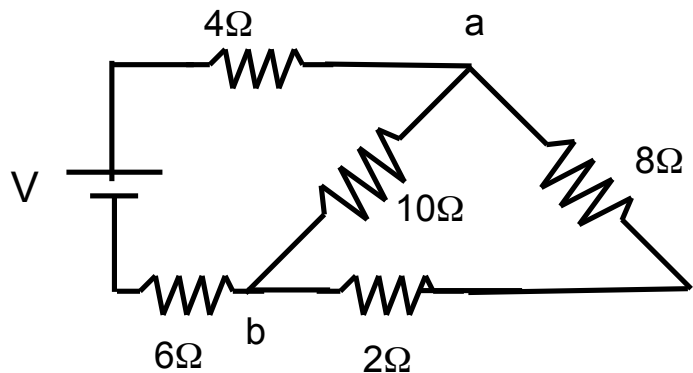
7. **[NOT COVERED IN WINTER 2011]** A wire carrying a current of 30.0 A , directed into the page, lies at the origin, as shown.
   a. On the diagram, draw the vectors representing the direction of the magnet field at the points (2,0) m and (2,1)
   b. Determine the magnetic field due to the wire at (2,1)m and
   c. the force on an electron which is moving in the x direction past the point (2,1) with a speed of 2×10^5 m/s.

y

•

(2,1) m

⊗   •→ X

I_{in}=30.0 A   (2,0) m
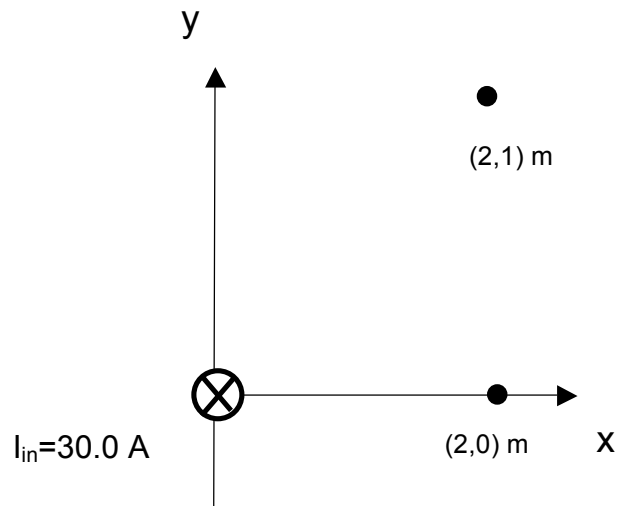
8.

    a. A proton and an electron are in a constant (uniform) electric field created by oppositely charged plates. You release the proton from the positive side and the electron from the negative side.   When it strikes the opposite plate, which one has more KE? Which particle is moving faster? Explain your answers.

    b.   A particle of mass 3.5g and a charge of +0.045µC is released from a rest in a uniform electric field with magnitude of 1200N/C, which points in positive x-direction.

        i. What is the magnitude and direction of the electric force exerted on the charge?
        ii. What is the change of the electric potential energy associated with the particle after moving through 5cm
        iii. Find the speed of the particle in this point.

9.

a. Suzy Soundlover stands between two speakers, separated by 6.5 m, as shown. The speakers emit the same tone of frequency 686 Hz. If the she stands 2.5 M from the left hand speaker , does she hear a loud sound or no sound? Support your answer

2.5 m
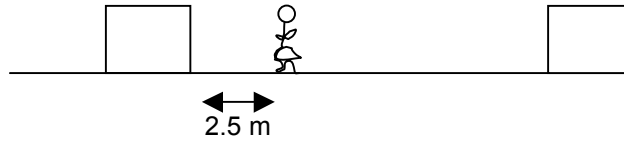
b. Suzy stands between two speakers and begins moving towards the right hand speaker with a speed of 3.0 m/s. If this speaker emits a frequency of 440 Hz, what frequency f_1 must the second speaker emit so that Suzy hears the same frequency from both speakers?

f_1

3.0 m/s

f=440 Hz