E SC MUSANZE **DATE:22/03/2020**

P O BOX 92 RUHENGERI **Class: S_6PCM+S_6PCB**

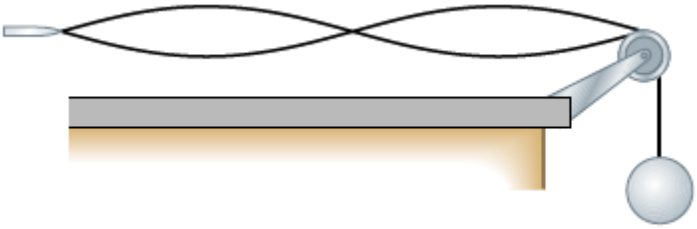
PACKAGE HOLLIDAYS

1.At t=0 a particle moving with simple harmonic motion is at x_0 =2cm ,where its velocity is given by $v_o = -24cm/s$.If the period of its motion is 0.5s and the frequency is 2Hz,find **a**)The phase constant. **b**) The amplitude .**c**)The displacement velocity and acceleration as a function of time. **d**)The maximum speed and maximum acceleration.

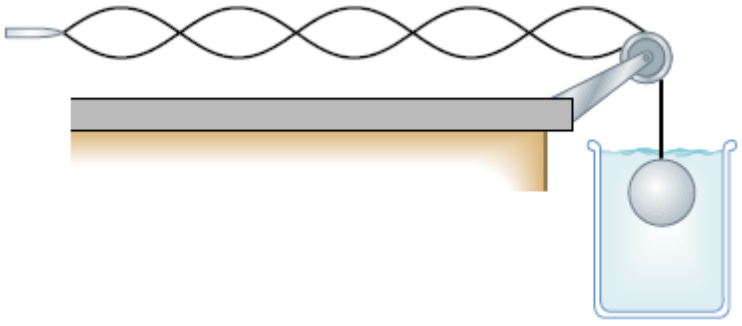
2.A generator at one end of a very long string creates a wave given by y=6cos[$\frac{\pi}{2}$(2x+8t)] and a generator at the other end creates the wave y=6cos[$\frac{\pi}{2}$(2x−8t)]. y and x are expressed in cm and t in seconds. Calculate **i**)the frequency. **ii**)The wavelength. **iii**)the speed of a wave.

b)For x≥ 0 ,what is the location of the node having; **i**)the smallest; **ii**)the second smallest; **iii**)the third smallest value of x?
c)For x≥ 0 ,what is the location of the antinode having; **i**)the smallest; **ii**)the second smallest; **iii**)the third smallest value of x?

3..One end of a horizontal string is attached to a vibrating blade and the other end passes over a pulley as in Figure a. A sphere of mass 2.00 kg hangs on the end of the string. The string is vibrating in its second harmonic. A container of water is raised under the sphere so that the sphere is completely submerged. After this is done, the string vibrates in its fifth harmonic, as shown in Figure b. What is the radius of the sphere?



(a)



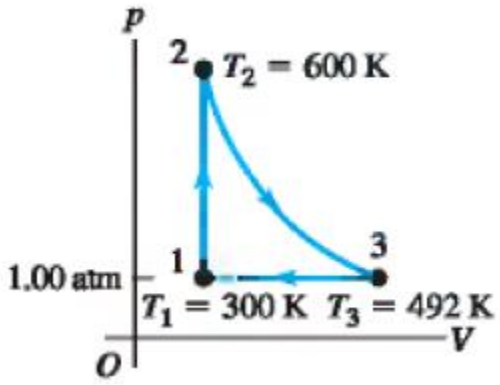
(b)

(**Given**:$\rho_{water} = 1000kg/m^3$ and g=9.8m/s^2)

4.Two train whistles, A and B, each have a frequency of 392Hz. A is stationary and B is moving toward the right (away from A)at a speed of 35m/s.A listener is between the two whistles and is moving toward the right with a speed of 15.0m/s. No wind is blowing. **a**)what is the frequency from A as heard by the listener? **b**)What is the frequency from B as heard by the listener? **c**)what is the beat frequency detected by the listener? (**Given:the speed of sound in air v=344m/s**)

5.An organ pipe has two successive harmonics with frequenctes 1372 and 1764Hz. **a**)Is this an open or stopped pipe? Explain. **b**)What two harmonics are these? **c**)What is the length of the pipe?

6.A heat engine takes a 0.350moles of a diatomic ideal gas around the cycle shown in the PV diagram of figure below. Process 1→2 is at constant volume;Process 2→3 is adiabatic and process 3→1 is at constant pressure of 1atm.The value of γ for this gas is 1.40.**a**)find the pressure and volume at points 1,2 and 3. **b**)Calculate the amount of heat Q, the work done W and the internal energy ΔU for each of the three processes.**c**)Find the net work done by the gas in the cycle.**d**)calculate the net heat flow into the engine in one cycle.**e**)What is the thermal efficiency of the engine. How does this compare to the efficiency of the carnot-cycle engine operating betwween the same minimum and maximum temperatures T_1 and T_2. **(1atm=1.013×10^{5}Pa ; R=8.3145J/molK; Cp=29.10 and Cv=20.79; n=0.350moles)**

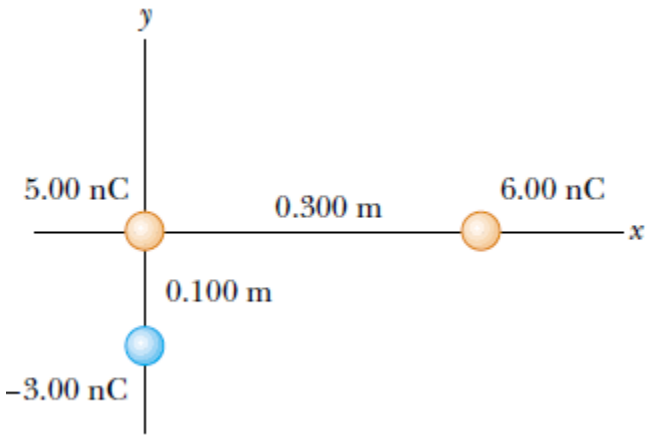


7.A cylinder contains a mixture of helium and argon gas in equilibrium at 150°C. (a) What is the average kinetic energy for each type of gas molecule? (b) What is the root-mean-square speed of each type of molecule? **(Given:K_B=1.38×10^{-23}J/k ;Avogadro's number=6.02×10^{23}molecules/mol)**

8.a.Liquid nitrogen has a boiling point of -195.81°C at atmospheric pressure. Express this temperature (**i**) in degrees Fahrenheit and (**ii**) in kelvins.

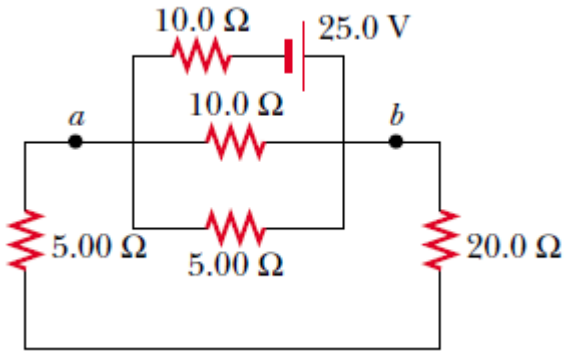
b.When alcohol is rubbed on your body, it lowers your skin temperature. Explain this effect.
c.Clearly distinguish among temperature, heat, and internal energy.

9.Three point charges are arranged as shown in Figure below. (a) Find the vector electric field that the 6.00-nC and -3.00-nC charges together create at the origin. (b) Find the vector force on the 5.00-nC charge.

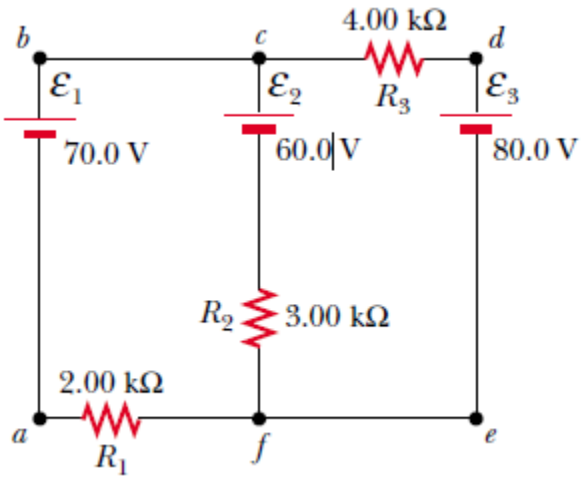


10.Two 2.00μC point charges are located on the *x* axis. One is at *x*=1.00 m, and the other is at *x*=-1.00 m. (a) Determine the electric field on the *y* axis at *y*=0.500 m. (b) Calculate the electric force on a -3.00μC charge placed on the *y* axis at *y*= 0.500 m.

11.Consider the circuit shown in Figure below. Find (a) the current in the 20.0-' resistor and (b) the potential difference between points *a* and *b*.



12.Using Kirchhoff's rules, (a) find the current in each resistor in Figure below. (b) Find the potential difference between points *c* and *f*. Which point is at the higher potential?



13. a) State whether each of the following statements is true or false.
Give reasons for your answer.
i) In an elastic collision of two bodies the momentum and energy of each body is conserved.
ii) Total energy of a system is always conserved, no matter what internal and external forces on the body.
iii) Work done in a motion of a body over a closed loop is zero for every force in nature.
iv) In elastic collision the final kinetic energy is always less than the initial kinetic energy of the system.
b) Body of mass 2kg initially at rest moves under the action of an applied horizontal force of 7N on a table with coefficient of kinetic 0.1.
Calculate **i)** the work done by the net force on the body in 10s.
ii) Change in kinetic energy of the body in 10s and interpret your results.

14.a.What is quantum mechanics?
b What is Planck's quantum theory?
c.Explain Planck's hypothesis or what are the postulates of Planck's quantum theory?
d. A laser emits light energy in short pulses with frequency 4.69×10^{14} Hz and deposits 1.3×10^{-2} J for each pulse. How many quanta of energy does each pulse deposit?

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