ST/STE PRETEST

1. An average sized banana (118 g) yields 454.300 kJ of heat when burnt to a crisp. If you managed to transfer all of the heat to a cup of water (250 g) at 20 ^{o}C, how warm would the water get?

   Specific heat of water = 4190 J (kg C) or 4.19 J (g C)

   $Q = mc\Delta T$
   $454\ 300\ J = 250\ g(4.19\ J/(g\ ^{o}C)(x - 20)$
   $x = 454\ ^{o}C$
   (That temperature will never be obtained for water---it'll boil off first, which means that a cup of water is too small to absorb all the heat.)

2. You want to cool 1000 kg of water at 40^{o} C to a comfortable 32^{o} C with only 258 L of water. How cold should that 258 L be, assuming that no heat is lost to the surroundings ?

   Density of water: 1.0 kg/L

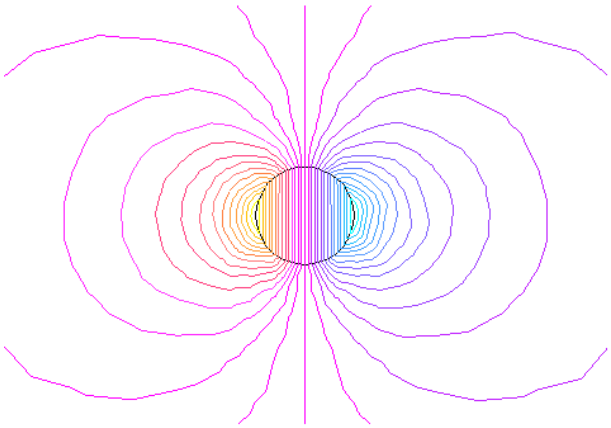
   $-Q_{hot} = Q_{cold}$
   $-1\ 000\ 000(4.19)(32-40) = 258\ 000(4.19)(32-x)$
   $-1000(-8) = 258(32 - x)$
   $8000/258 = 32 - x$
   $x = 32 - 8000/258$
   $x = 1\ ^{o}C$

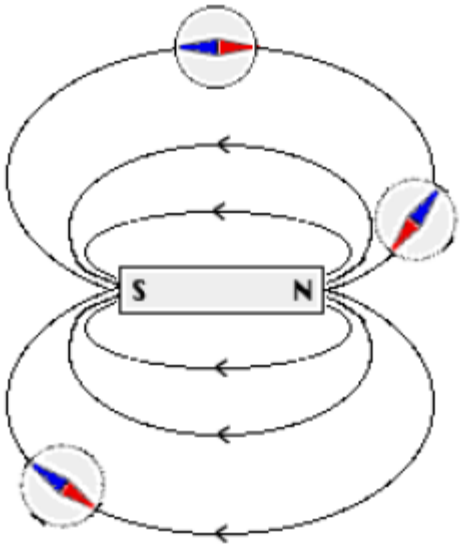
3. Which of the following materials form domains?

a. plastic__no_
b. silver(Ag)__ no_
c. copper(Cu)__ no_
d. cobalt(Co)__yes
e. neodymium(Nd)_ yes Fe,Nd,Co,Ni

4. What will happen to a ferromagnetic material like nickel if it comes into contact with a temporary magnet?
   It will stick to it.

5. Draw the domains within a permanent spherical magnet.





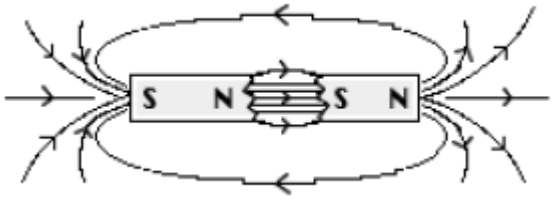
6. a) In the diagram above, are the magnetic field lines drawn correctly? yes

b) Label the North end of each compass needle. North is blue

c) Modify the diagram so that it represents a stronger magnet. Add more lines

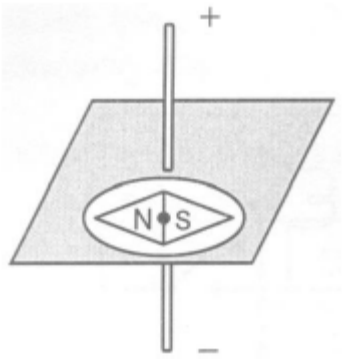
7. a) In the diagram below, can you predict whether the 2 magnets are attracting? Yes they are. Look at N and S in the middle.

b) Are the magnetic field lines correctly represented in between the two



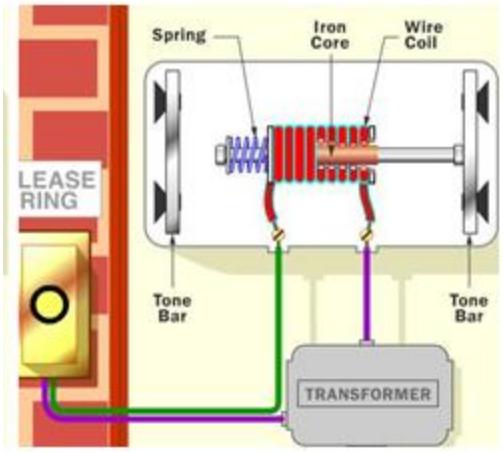
opposite poles? Yes

8. Why does the compass point to the left?



a. Apply the left hand rule. Have your thumb point up because the electricity is flowing straight (like your thumb) from (-) to (+). Notice that the rest of your fingers point left. This is the direction of the magnetic field in front of the wire. The field is caused by the moving electrons.

9. The diagram is a snapshot of the doorbell after someone has pushed the button and after the spring has driven the iron core towards the second tone bar.



a) Why did the iron core hit the first tone bar?

The magnetic field was created by the solenoid when electricity was turned on. This pulled in the iron core.

b) If electrons in the left wire are flowing upwards, where in the solenoid is the north pole of the magnetic field?

On the left.

c) Does an iron bar react any differently if the polarity is switched?

No.

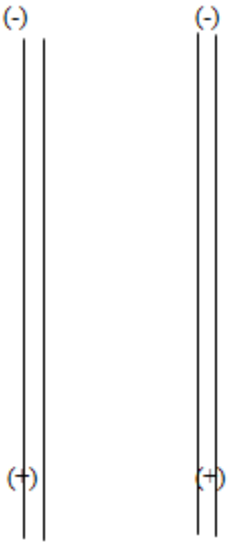
d) What are two ways of switching the polarity of the magnetic field of a solenoid?

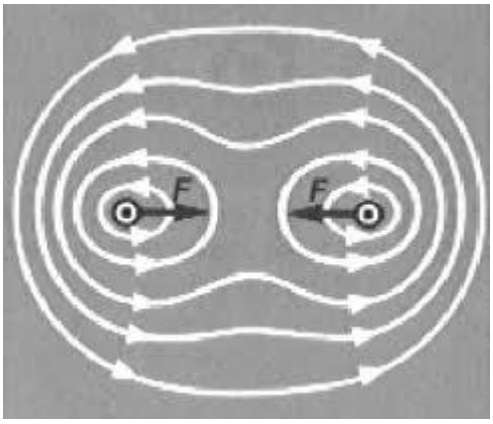
Wind the coil in the opposite way around the cylinder(solenoid) or switch positive and negative.

e) List three ways of making the iron hit the tone bar with more force.

Increase voltage; use more turns in solenoid; use Nd instead of iron.

10. Imagine a very strong current flowing through two parallel wires. The electrons in the two wires are both flowing in the same direction. Draw the magnetic field around each wire. The resulting magnetic fields will interact. Will the wires repel or attract?





They will attract.

11. A coffee maker is connected to a 120 V outlet. The resistance, *R*, of the heating element of the coffee maker is 20 Ω. This coffee maker works for 15 minutes.

a) How much energy in joules is used by the heating element of the coffee maker during this period?

E = VIt
= 120 J/C(120/20)C/s(15*60 s)
= 648 000 J

V=IR, so I =V/R=120/20

b) What is the power rating of the coffee maker?

P = VI
= (120 J/C)(6 C/s) = 720 W = 720 J/s

c) How much will it cost to operate the coffee maker every year if it's used 15 minutes per day in a non leap year? Assume cost $0.075/kWh.

Every day: 648000J (1kWh/ 3 600 000 J) = 0.18 kWh
Whole year: 365*0.18kWh = 65.7 kWh

65.7 kWh($0.075/kWh.) = $4.93

12. a) If a material heats up easily, does it usually cool off easily as well?

YES

b) What can be said about the specific heat of this material?

It will be low.

c) Give an example of a possible material with the above characteristics.

Most metals.

13. A series circuit with three light bulbs has voltage drops of 1.2 V, 1.4 V and 1.4 V. The ammeter measures 0.50 A.

a) What is the wattage of the bulb that consumes the least energy?

P = VI = 1.2J/C(0.50 C/s) = 0.6 J/s = 0. 6 W.

b) How much energy is used by all three bulbs every hour they're turned on?

V_t = 1.2+1.4+1.4= 4.0 V
E = VIt=4(0.5)(3600 s) = 7200 J