Did you remember:

auf bau


Hund's Rule

http://www.kentchemistry.com/links/AtomicStructure/PauliHundsRule.htm

Pauli exclusion principle

https://www.youtube.com/watch?v=LJ-sP0ihzbw

https://www.youtube.com/watch?v=e-TMtRh8AIs
Electricity Questions:

1. What is the difference between an insulator and a conductor?
   Provide 2 examples of each.
   - **Insulator**: electrons do not move freely  rubber, plastic, dry air, glass
   - **Conductor**: electrons can move freely, permit other electrons to move through most metals, skin, wet/humid air

2. In an atom, where would you find each of these:
   a. protons  nucleus  b. neutrons  nucleus  c. electrons  cloud

3. A neutral object becomes ________ charged if electrons are removed.

4. Two objects have collected static electricity with the same charge. What would the objects do when placed near each other?
   they would repel each other

5. What does it mean when we say an atom is neutral?
   it has an equal number of protons (+) and electrons (-)
6. If the overall net charge is the sum of all charges on an object, what is the significance of an overall net charge that is negative?

There are more e- on the object than protons.

7. How is a static charge created?  friction

8. What is a Coulomb?  the unit for charges

9. What does an electroscope indicate?  presence of charge

10. How can you use an electroscope to determine the charge of an unknown object?  bring the object close to the electroscope:

   *if it is neutral, the electroscope will not change.*

   if it has a charge, you can bring in an object whose charge is known. if that object and the unknown attract, they are opposite, otherwise they are similar (same charge).
11. Explain how a static charge is generated. What are the characteristics of a static charge?

Excess of electrons builds up on an object. Often a result of friction.

12. Use diagrams to illustrate the electric field around the following:

a (+) charge

strong charge.

a (-) charge

(+) charge twice as strong as the first
13. Briefly explain “charge separation” (outline the basic steps).

1) A rod with (-) charge is brought near a neutral electroscope.

2) Electrons located at the top of the electroscope will be repelled from the incoming rod. They will flow down into the leaves, the farthest place from the (-) source.

3) The leaves now have excess electrons, and overall (-) charge.

4) The leaves will repel each other.

14. Briefly explain “charging by conduction” (outline the basic steps).

1) A (-) rod is brought to a neutral electroscope.

2) As the rod approaches, e- on the electroscope are repelled toward the leaves. This leaves the top with an overall (+) charge.

3) The (-) rod makes contact with the head and transfers e-.

4) When the rod is removed, the electroscope has an overall (-) charge.
15. Briefly explain “charging by induction” (outline the basic steps).

**Example:**
1) Starts like charge separation
2) While the (-) rod is present, an object **touche**s the **electroscope** and the "excess" e- are drained.

   3) When the rod is taken away, the electroscope is left with an overall (+) charge.

16. What is a capacitor? Briefly explain the structure and function.

   device used to store charge. May be used to drain "excess" charge from an object.

17. What do we mean by the term “grounding”. What types of objects can provide this? provides a pathway for charges to reach Earth surface.

   people, metal rods, trees
18. What is the *ultimate* destination of charges that are being grounded?

   Earth!

19. Provide an illustration demonstrating how charged particles are distributed
   a) on a neutral object.

   ![Illustration of charged particles on a neutral object]

   b) on an object that has experienced charge separation.

   ![Illustration of charged particles on an object with charge separation]
20. Be able to use Coulomb’s Law to solve problems.

\[ F = 2.0 \times 10^{-6} \]

a) A point charge of + 2.0 \( \mu \)C is located 0.15 m from a second point charge of - 4.0 \( \mu \)C. What is the magnitude and direction of the force on each charge?

\[
8.99 \times 10^9 \times \frac{[5.0 \times 10^{-6} \times 4.0 \times 10^{-6}]}{0.15^2} =
\]

\[ F = 3.2 \text{N} \text{ attractive} \]
b) Two charges of equal magnitude exert an attractive force of $4.0 \times 10^{-4}$ N on each other. If the magnitude of each charge is $2.0 \, \mu$C, how far apart are the charges?

\[ q_1 = 2.0 \times 10^{-6} \, \text{C} \]
\[ q_2 = 2.0 \times 10^{-6} \, \text{C} \]
\[ F = 4 \times 10^{-4} \, \text{N} \]
\[ r = ? \]

\[ F = k \frac{q_1 q_2}{r^2} \]

\[ \frac{F}{k} = \frac{q_1 q_2}{r^2} \rightarrow \frac{1}{F} = \frac{r^2}{q_1 q_2} \]

\[ r^2 = \frac{8.99 \times 10^9 \times (2.0 \times 10^{-6}) \times (2.0 \times 10^{-6})}{4.0 \times 10^{-4}} \]

\[ r^2 = 89.9 \]

\[ r = 9.48 \text{ meters} \]
21. What is the electric force?
   the influence a charge has on its surroundings.

22. What factors will affect the force between 2 charges?
   strength of the charge, whether they are same or opposite charges, distance between the charges.

23. Explain the process by which lightning is created.
   • tall thunderstorms; ice crystals form;
   • as ice falls, collisions occur;
   • Collisions → electrons released from the crystals; cloud becomes (-);
   • Excess (-) in cloud forces (-) away on the ground;
   • **Lightning** = discharge of excess (-) to the ground
**Magnetism Questions:**

24. What is a magnet?

   object that either contains paired e-that spin in the same direction or a single electron that spins

25. Why is an electron’s spin significant?

   spinning electron that is not "cancelled" by an opposite spin will create a magnetic field.

26. What is a domain?

   region where all electrons are spinning in the same direction.

27. What is true about the domains in a permanent magnet?

   they are all oriented in the same direction

28. What is the arrangement of domains in a non-magnetic substance?

   random!
29. Explain the importance of valence electron configuration in determining whether a substance will be magnetic.

   d or f orbitals  \hspace{1cm}  \text{unpaired electrons}

30. Explain how a permanent magnet could be de-magnetized (>1 example).

   heat it up (excessive heat), strike/drop it

31. In a magnet  \underline{\text{opposite}}  \hspace{1cm} \underline{\text{similar}}  \hspace{1cm} \text{poles will attract, and } \underline{\text{poles will repel.}}
32. Sketch two “North” magnet ends that are repelling.

Hint: What should the field lines look like?

33. What type of magnet is the Earth?

Electromagnet

34. According to the most recent research, how is the magnetic field of the Earth formed?

http://esamultimedia.esa.int/multimedia/edu/PlanetaryMagneticFields.swf
This animation shows a cross section of Earth; it illustrates a mathematical model of how convection might occur in the mantle.

In the model, red represents heated materials that are less dense than their surroundings. Dark blue represents cooler materials that are denser than their surroundings.
35. *Draw and label* a permanent bar magnet with magnetic field lines in the proper direction.

36. What is magnetic flux? How does it relate to the magnetic field and the magnetic force?
   - # of field lines in an area
   - It is an indication of field strength

37. What is formed when you run current through a wire?
   - an electromagnet

38. Using the first right hand rule, a hand gripping a wire with current flowing indicates current with the **thumb** and indicates the direction of the magnetic field with the **fingers**.
39. What is an electromagnet?
   a temporary magnet; needs an electric current

40. What is a solenoid?
   wires wrapped around a metal core

41. What happens when the direction of current in a solenoid is reversed?
   poles of the magnet are reversed

42. How does the number of coils in an electromagnet affect its strength? What other factors could you change to alter the strength?
   \[
   \text{↑ # Coils = ↑ Strength} \\
   \cdot \text{Current} \\
   \cdot \text{add core / take it out} \\
   \cdot \text{uncoil wire = ↓ strength}
   \]
Attachments

es0805_convection.swf