ST January 2013 Review

1. Classify as a chemical or physical change:

    a. Two powders are crushed and an enormous amount of heat and sound are released_
    Chemical because a lot of energy is released

    b. A compound of CH_3OH boils until it all evaporates_____
    Physical; boiling will vaporize it but it's still CH_3OH

    c. A nail is hammered into a wall_____

    Physical; nail's composition remains the same

    d. Skin forming a scab after it has been slightly cut.
    _____
    Chemical; colour change signifies new compounds are being created as skin grows and repairs wound.

    e. Five precious Belgian chocolates melt in your mouth_____
    Melting like boiling, freezing etc is physical

    f. Paint dries. Its mass *increases* as it forms a compound with oxygen._____
    New compound = chemical

    g. Zinc and oxygen combine to form ZnO_____
    New compound = chemical

    h. Radio waves pass through your body_____
    Physical= no harm form radio waves; no chemical change to DNA or anything

2. Balance the following equations:

    a) $2KClO_3$ + $3 S$ → $2 KCl$ + $3 SO_2$

b) 2 H_3PO_4 +   3 $CaBr_2$ → $Ca_3(PO_4)_2$ +   6HBr

3. You observe the reaction between CaS and 2 HCl which produces $CaCl_2$ and the poisonous H_2S .

The mass before the reaction was 143 g. The products only weighed 111 grams. What happened? Was mass conserved? If so why aren't the masses equal?

Total mass is conserved but a gas probably escaped, leading to a lower mass for the remaining solid

4. A student dissociated water using acid and electricity. If he measured approximately 27ml of hydrogen, how many ml of oxygen was probably obtained?

When 2 H_2O split, you get 2 H_2 and only 1 O_2, in other words half as much oxygen as hydrogen, so the answer = 27/2 = 13.5 ml

5. As a result of his famous experiment in which a thin sheet of gold foil was bombarded with alpha (α) particles, **Rutherford** significantly changed the atomic model proposed by Thomson.

The diagram below shows the trajectory of alpha particles passing through a thin sheet of gold foil or, in rare instances, being deflected on its surface.

Moveable
fluorescent
screens

Source of
alpha
particles

Lead block
with small
hole in it

Thin sheet
of gold foil
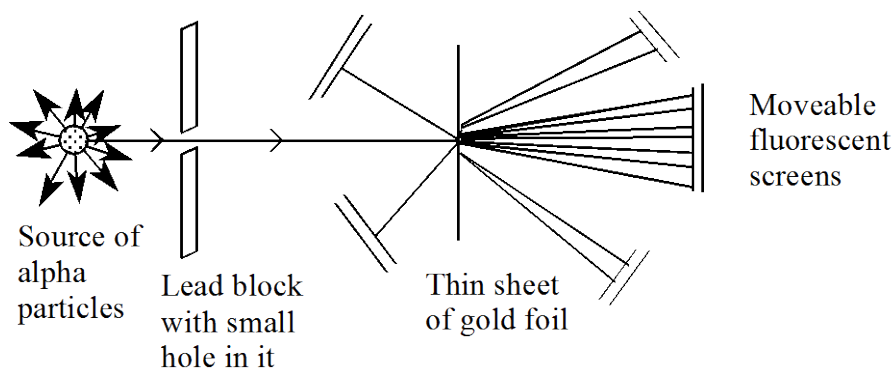
Explain the results of this experiment.

A few particles bounced back from the foil because they hit the small but massive nuclei of the gold atoms. This lead to the realization that an atom is mostly empty space except for that important dense positive nucleus.

6. Use your knowledge of the periodic table families to fill in the blanks

   a.   The smallest alkaline earth metal is beryllium= Be

   b.   The family that reacts with most metals is the halogens
   c.   The least reactive family is the noble gases

   d.   alkali metal = Li + Br_2 →   2 LiBr

7.   How many electrons does a neutral atom of boron have?
      5

8.   How many protons are in a neutral atom of Ar?

      18

9.   Which, if any, of the following has more electrons? P^{-3} or S^{-2}
      Show work

      Electrons = protons – charge
      P^{-3} electrons = 15 - -3 = 18
      S^{-2} electrons = 16 - -2 = 18

10.   Your school's lab technicians have designed an interesting lab that uses calcium (Ca) but the school's shipment of calcium has not yet arrived. Rather than disappointing their students, the lab technicians decide not to cancel the lab and try to find a replacement for calcium.

a) Which element could replace calcium in the experiment? Explain your answer.

Mg could= same family

b) Draw a Rutherford- Bohr, a Thomson model and a Lewis diagram of calcium and the replacement element.

Rutherford-Bohr

Ca   20p   2e)8e)8e) 2e

Mg   12p   2e)8e) 2e

Thomson: draw a big circle with a mish mash of (+) or (-) for both

Lewis

Ca:

Mg:

Both have a valence of 2

11. While building a machine for the science fair, you test a number of substances to determine how well they can conduct an electrical current.

Substance A	A sugar cube
Substance B	An iron nail
Substance C	Sea water (NaCl)
Substance D	Table salt (NaCl)
Substance E	HCl Solution
Substance F	NaOH solution

There is a chemical spill that releases magnesium hydroxide ($Mg(OH)_2$) into the soil. Originally the pH of the soil is 7, after the spill the pH is 9. Two products: aqueous hydrogen iodide (HI) and potassium hydroxide (KOH) are available to neutralize the chemical spill.

  a) Choose the product that will neutralize the spill. Justify your answer.

  You need the acid HI

b) Complete and balance the chemical equation for this reaction.

$$Mg(OH)_2 + \_\_2\ HI\ \_\_\_\_ --> \quad 2\ H_2O + \quad MgI_2$$

12.   Which of the following is the **most concentrated** solution? *(2 marks)*

a)   30 g of solute / 5L of solution   = 6g/L most conc.

b)   5 g of solute / L of solution   = 5g/L

c)   0.1 g of solute /10L =0.01 g/L

d)   3500 ppm solution= 3500 mg/L = 3.5 g/L

13.   What type of energy(chemical, electrical, etc) is exemplified by each of the following:
  a) The energy stored in unburned oil chemical
  b) The energy flowing through the copper wire leading to a lamp
     electrical
  c) The energy released by a radioactive nucleus nuclear
  d) The energy of visible light solar

14. If an engine is 15 % efficient, how much energy does it waste if is supplied with 2000 kJ worth of gasoline? Show work.

$$x/2000 = 0.15$$

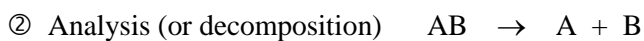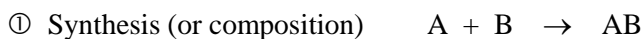x = 300 kJ of useful energy

2000 – 300= 1700 kJ wasted

Or

100%-15% = 85% wasted

0.85*2000 kJ = 1700 kJ wasted

Part 2

PART 2

1. Three simple classifications of chemical reactions are:

① Synthesis (or composition)   A + B → AB

② Analysis (or decomposition)   AB → A + B

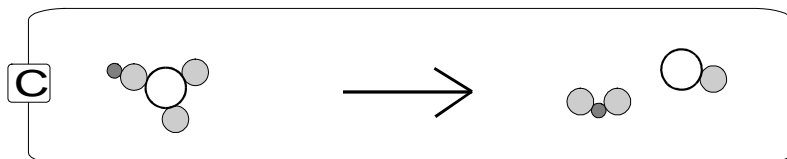③ Displacement   AB + C → AC + B

The following illustrations represent the three reactions listed above; classify them:
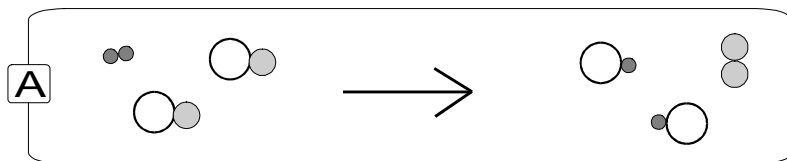
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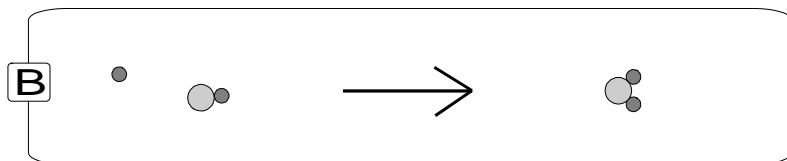
1

2

2. The following table lists the characteristics of a certain liquid.

| CHARACTERISTICS |
|---|
| Produces a gas when in contact with a piece of metal. |
| Conducts electricity. |
| Turns litmus paper red. |

How would you describe this liquid?

A) The liquid is a neutral solution.

B) The liquid is an acidic solution.

C) The liquid is a basic solution.

D) The liquid is a neutral salt solution.

3. a) Write the balanced equation for cellular respiration.

$C_6H_{12}O_6$ + ____6 O_2_____ → 6 H_2O + 6 CO_2

b) What is the ratio of products produced?

1:1

4. When 191 g of copper, Cu, is combined with 756 g of nitric acid, HNO_3, the chemical reaction produces 563 g of copper nitrate, $Cu(NO_3)_2$, 108 g of water, H_2O, and a certain amount of nitrogen dioxide, NO_2. This reaction is represented by the following balanced chemical equation:

$$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$$
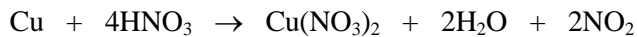
What mass of nitrogen dioxide does this reaction produce?

$191 + 756 = 563 + 108 + x$

$x = 276$ g

5. Anna Banana needs to neutralize a window-cleaner that contains ammonia. When she tests it with red litmus paper, the paper turns blue.

   a) What type of substance must she use to neutralize the cleaner? _____acidic_____

   b) What will 2 compounds will be produced after she neutralizes it? _____salt and water_____

6. In the laboratory, you are to neutralize an acid solution before disposing of it. Explain in detail how you would neutralize this solution. In you explanation, indicate the **material used and the steps involved.**

   1. Add an indicator
   2. Slowly add base until you see a permanent color change.

7. What are electrolytes?

They are solutions which conduct electricity, usually because they contain ions that can moe towards each electrode.

8. What are ions?
They are charged atoms. They contain an imbalance of protons and electrons. If electrons> than protons, then the ion is negatively charged. The opposite is true for a positively charged ion.

9. How many electrons do the following ions have: Ca^{2+} , O^{-2}, K^{+1}

Ca^{2+} $20 - 2 = 18$
O^{-2} $8 - (-2) = 10$
K^{+1} $19 - 1 = 18$

10. Are the following acids, bases, salts or neither? If they are electrolytes, what is there ionic dissociation?

Ionic Dissociation

a) HBr   **acid**   **H⁺ + Br⁻**

b) H₂O   neither

c) CH₄O   **neither(non-electrolyte)**

d) CaCl₂   **salt**   **Ca²⁺ + 2 Cl⁻**

e) NaOH   **base**   **Na⁺ + OH⁻**

                                          _

11. The following diagram shows a solution being tested for electric conductivity with a conductivity meter.

Explain **why** and **how** the light bulb lights up for each sample being tested. You must refer to

- The nature of the solution.
- Ionic dissociation.
- The nature of the materials used in the conductivity meter.
- The components or construction of the conductivity meter.

NaOH(aq)
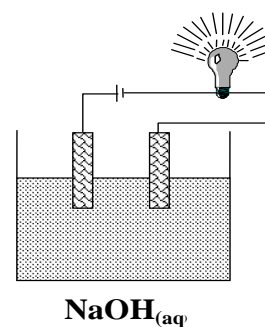
The solution is an electrolyte. Specifically it`s a base because it consists of a metal ion(Na⁺)and a hydroxide group(OH⁻). It will dissociate into those ions when mixed with water, which will travel towards opposite electrodes, allowing the electricity to be conducted.

The conductivity materials will include a battery, a light bulb, metal electrodes and conducting wires.

12. Convert the following concentration into ppm.

a) $\frac{4\,g}{L}$ 4000 mg/L = 4000 ppm

b) $\frac{5\,g}{kg}$ 5000 ppm   a kg of water = 1 L

c) $\frac{0.06\,g}{100\,mL}$ 60 mg/0.1 L = 600 ppm

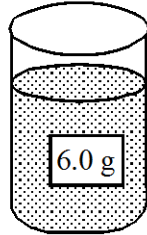d) $\frac{0.7\,g}{100\,g}$ 700 mg/ 100 ml = 700 mg /0.l L = 7000 ppm
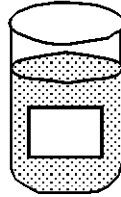
13. Consider the 4 solutions below :

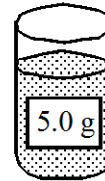Solution   Solution   Solution   Solution

1.0 g	6.0 g		5.0 g
100 mL	3 L	4000 ppm	200 mL

List the solutions from least to most concentrated.

A   1g/0.L = 10 g/L
B   6g/ 3L = 2 g/L
C   4000 mg/L = 4 g /L
D   5g/0.2 L = 25 g/L

Most conc. D
Least concentrated B

14. What type of energy are the following objects associated with? (2 marks)

    a.   Silicon wafer panel   solar

    b.   Eating food   chemical

    c.   Hydro dams   electrical

    d.   Batteries   chemical

15. A toy car consumed 4000 kJ of energy.

a) If its efficiency is only 15%, how much energy is actually used to move the car? Show all your work. (3 marks)

0.15(4000) = 600 kJ

b) If the car consumes triples the amount of energy, how much energy is wasted? Show all your work. (2 marks)

16. What type of energy are the following objects associated with?

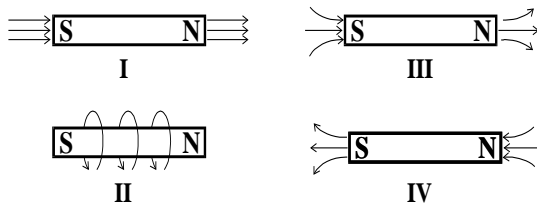   A power plant using uranium   nuclear
      Candle   chemical
      Food   chemical

17. Marc wants to draw a sketch representing the magnetic field he observed around a current-carrying solenoid he used in the laboratory. Which sketch is *correct*?

A)   C)

B)   D)
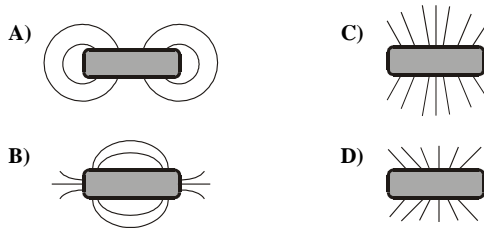
18. Which of the following diagrams represents the magnetic lines produced by a bar magnet?

              S   N   S   N
                    I   III

              S   N   S   N
                   II   IV

   A) I   C) III

   B) II   D) IV

19. Draw the direction of an electron current.
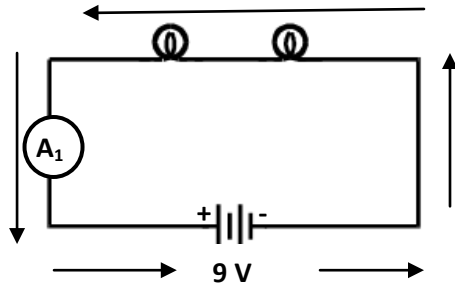
20. What are the 4 factors that influences the conductivity of a material?

Temperature
Thickness
Type of material
length

21. The four conductors shown below are made out of copper. Which one has the greatest conductance

A)

B)

C)

D)

B

22. Which pair of substances can be used as conductors is an electric circuit?

A)	Aluminum and copper	C)	Copper and glass
B)	Aluminum and porcelain	D)	Porcelain and glass

A

23. A manufacturer wants to insulate an electric wire with a non-conducting material. Which one of the following materials ***cannot*** be used for this purpose?

A) Ceramic

C) Plastic

B) Graphite

D) Glass

B

24. In every neutral atom, the number of electrons is:

A) less than the number of neutrons

B) equal to the number of neutrons

C) greater than the number of protons

D) equal to the number of protons

D

25. Which of the following substances are conductors?

1-Rubber 2-Plastic 3-Aluminum 4-Copper 5-Steel

A) 1 and 2 C) 2, 4 and 5

B) 1 and 3 D) 3, 4 and 5

D

26. Which of the following properties of stainless steel explain why stainless steel pots may be used to cook food?

1- Not easily distorted
2- Average conductor of electricity
3- Good conductor of heat
4- Does not corrode
5- High density
6- High melting point

A) 1, 2 and 3 C) 2, 4 and 5

B) 5 and 6 D) 3, 4 and 6

D

27. When we rub a glass rod with silk, the rod becomes electrically charged. What happens during the rubbing process?

    The one that is higher on the list becomes negatively charged.

- Rubber
- Silk
- Wool
- Glass

Electron are transferred from the glass to the silk.

28. A student conducted an experiment involving three electrically charged spheres A, B and C. The steps in the experiment and some of the results are given below.

STEP	RESULT
1. Bring sphere A close to sphere B.	1. They attracted each other.
2. Bring sphere A close to sphere C.	2. They repelled each other.
3. Bring sphere B close to sphere C.	3. ?

Given the above information, what was the result of Step 3?

Attraction

29. A balloon rubbed against human hair becomes negatively charged with static electricity.
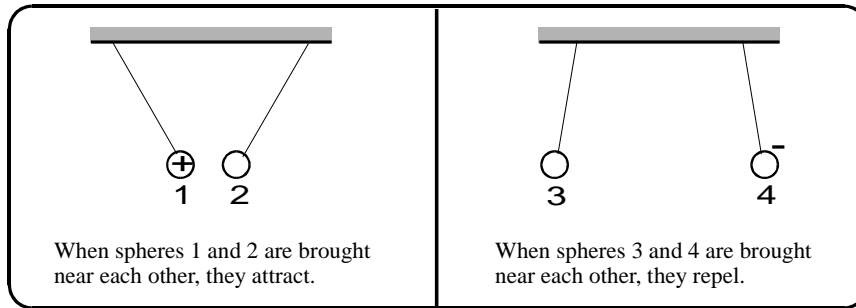
Draw 3 diagrams and use (+) and (−) signs to show the electric charges and arrows to show any transfer of charges. **Explain each of the three steps.**

Show an equal number of + and – originally. Then show electrons being transferred from the hair to the balloon. Finally show that the hair is left with a positive charge while the balloon is negatively charged.

30. There are three simple ways to charge an object electrically: by rubbing, by direct contact and by induction. Which of the following statements are true?

    1.   It is very easy to charge a conductor by contact.
    2.   By rubbing, glass picks up electrons from silk and becomes positively charged.
    3.   An object charged by induction remains electrically neutral overall.
    4.   In a clothes drier, the clothes can become charged by contact.

4

31. Spheres 1, 2, 3 and 4 are electrically charged. The charge on sphere 1 is positive and the charge on sphere 4 is negative. We do not know the type of charge on spheres 2 and 3.

When spheres 1 and 2 are brought near each other, they attract.

When spheres 3 and 4 are brought near each other, they repel.

What type of charge is on sphere 2 and on sphere 3?

Both are (-)

32. Which of the following is **TRUE** concerning a *series* circuit?

I-   The current through each element (resistor) is the same.
II-   The voltage drop across each element (resistor) is the same
III-   The sum of the voltage drops equals the power source voltage.

a) I   b) II   c) III   d) I and II   e) I and III

E

33. Which of the following is **TRUE** concerning a *parallel* circuit?

I-   The total resistance is less than the resistance of the lowest value resistor.
II-   Adding a resistor in parallel decreases the total resistance.
III-   Adding a resistor in parallel increases the total resistance.
IV-   The feed line current increases as more resistors are added in parallel.

a) I and II   b) I and IV   c) II and IV   d) I, II and IV   e) I, III and IV
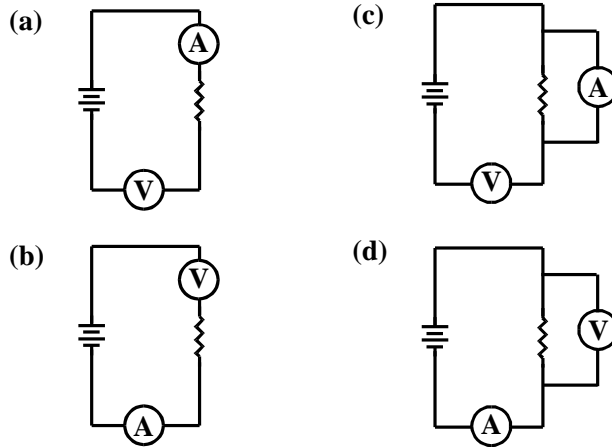
D

34. What must be the value of a resistor so that when connected in *parallel* with a 12 Ω resistor it produces a total resistance of 3 Ω ?

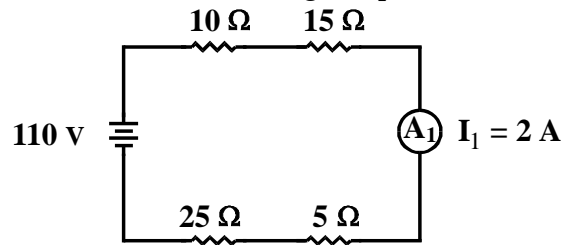a) 1 Ω   b) 2 Ω   c) 3 Ω   d) 4 Ω   e) 6 Ω

D $1/12 + 1/x = 1/3$

35. Which of the following diagrams is *correct*?

(a)

(c)

(b)

(d)

36. For the circuit below, what are the *voltage drops* across the 15 Ω and 25 Ω resistors respectively?

10 Ω   15 Ω

110 V A_1 $I_1 = 2$ A

25 Ω   5 Ω

a) 20 v and 30 v
b) 10 v and 50 v
c) 30 v and 50 v

d) 20 v and 50 v
e) 30 v and 10 v

V = IR

37. The circuit on the right consists of 4
   resistors whose values are 2 Ω, 4 Ω,

   7 Ω and 5 Ω respectively.

$R_1 = 2\,\Omega$ $R_2 = 4\,\Omega$

I = ? A

9 V   A

$R_4 = 5\,\Omega$ $R_3 = 7\,\Omega$
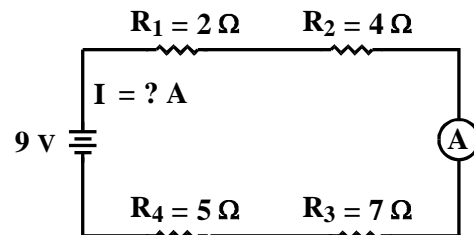
   Calculate the reading of the ammeter.

_____

38. The following electric circuit consists of two resistors (R_1 and R_2) and a power source. What is the equivalent (or total) resistance of the circuit?

$R_1 = 20\ \Omega$

$R_2 = 20\ \Omega$

A) 0.1 Ω   C) 20 Ω

B) 10 Ω   D) 40 Ω

D

39. A) For the circuit below, would the 5 Ω resistor receive current if a switch was placed between the last two resistors?

NO

b) How would you assemble a circuit so that

a switch would allow only the last two

resistors to receive current?

Create a parallel circuit where there is a choice

for electrons to go through either the 25 or 5 Ω

branch or through the 20,50 branch. Place the swi

25 Ω

A₁   5 Ω   V₁

V₂

200 v   20 Ω

A₂   50 Ω   V₃

40. The circuit is composed of a 6.0-V battery connected to a 10-Ω resistor. It includes an ammeter and a voltmeter connected to the resistor terminals. How much energy will the resistor release in one minute's work?

$E = VIt$
$= 6(6/10)(1*60 \text{ s}) = 216 \text{ J}$

41. At the hottest setting, a blow dryer uses 90 000 J in 60 seconds. What is its power rating?

$P = E/t = 90000/60 = 1500 \text{ W}$

42. A 1000 W heater is turned on for 4 hours. How much energy is used?

$E = Pt = 1000\text{J/s} *4\text{h}*3600\text{s/h} = 14400000 \text{ J} = 14400 \text{ kJ}$

43. Which of the following has no influence on TIDES?

(A) Moon gravitational tug
(B) Earth and ocean's inertia
(C) Sun
(D) Earth's magnetic field

D

44. How many low tides do we get approximately every 25 hours?
(A) 1
(B) 2
(C) 3
(D) 4

b

45. Why does it take more than 6 hours (instead of 24/4 = 6) to get from one tide to the next? That's because while the earth spins on its axis…..

(A) The moon also rotates on its axis
(B) The moon rotates around the earth
(C) The sun rotates on its axis
(D) The earth slows down due to the moon's gravitational tug

B