UNIT 1 - Dynamics of Ecosystems

1. Briefly define or explain the following terms:

a. Ecosystem: environment where all organisms interact through the transfer of energy

b. Trophic level: each step in a food chain/web

c. Bioaccumulation: the increase in toxin concentration from one trophic level to another

d. Nitrogen Fixation: process of changing nitrogen into ammonia and nitrates

e. Producer: autotrophic organism who receive energy from the Sun ie) plants

f. Consumer: heterotrophic organism who receive energy by eating other organisms

g. Omnivore: consumers who eat both producers and consumers

h. Carnivore: consume lower consumers

i. Herbivore: consume producers

j. Food Chain: linear relationship that shows the transfer of energy in an ecosystem

k. Decomposer: breakdown dead organisms and animal waste

l. Carrying Capacity: max number of organisms that an ecosystem can support indefinitely

m. Herbivore: _____

n. Photosynthesis: process in which green plants make food from H_2O, CO_2 and sunlight

o. Primary consumers: only consume producers (2nd trophic level)

p. Secondary consumers: only consume primary consumers (3rd trophic level)

q. Community: collection of all populations in a particular area at a specific time

r. Population: group of organisms that belong to the same species

s. Niche: the place and role of an organism in an ecosystem

t. Predator: in search of food

u. Prey: potential meal

v. Scavenger: consumer organic waste and remains

w. Autotroph: uses energy to make its own food

x. Heterotroph: _organism that is incapable of making its own food_

y. Food Web: _diagram linking all food chains together_

z. Population density: _the size of the population in a specific area_

aa. Pyramid of Energy (a.k.a. Trophic Pyramid): _shows the amount of energy required at each trophic level_

bb. Limiting Factors: _factors that affect the size of the population_

cc. Invasive Species: _species not native to an ecosystem that can alter the ecosystem_

2. Describe the difference between abiotic and biotic factors.

Abiotic - non-living
Biotic - living

3. What is the difference between intraspecific competition and interspecific competition? Give an example of each type of competition.

Intra - between same species
    ex) two rams fighting for one ewe.

Inter - between 2 different species
    ex) deer and elk wanting grass.

4. What is the difference between density-dependent and density-independent limiting factors, and give examples of each?

DD - affects population due to the size
    ex) food shortage, disease

DI - affects population regardless of size
    ex) volcanoes, floods

5. While walking in Assiniboine Park recently, someone noticed at least one of each of the following organisms. The list included rabbits, oak trees, deer, forest tent caterpillars, mice, clover, hawk, grass, fox and squirrel.

From the list above, which organisms are *producers?*
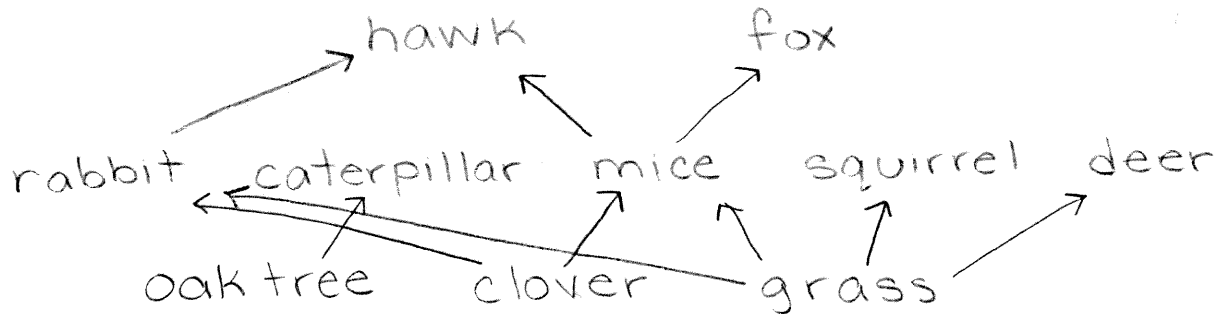
oak trees, clover, grass

Which organisms are *primary* consumers?

rabbits, caterpillars, mice, squirrel, deer

Which organisms are *secondary* consumers?

hawk, fox

6. Draw *a food-web* which illustrates the relationships between the organisms listed above.

7. Use these organisms to create a food chain: decomposers, fish, hawk, algae
   a. What is the producer in the food chain? What is its function?

   algae, function is to bring energy into the food chain

   b. What is the primary consumer? Secondary consumer?

   primary = fish
   secondary = hawk

   c. Where would decomposers fit into the food chain? What is their role?

   Decomposers fit at every level.
   Their role is to break down dead organisms and put carbon back into the cycle.

8. How much energy passes from one level of a food chain to the next higher level?

   10%

9. Why do food chains rarely contain more than four trophic levels?

At each level there is less energy available There would not be enough energy or animals to support a fifth trophic level

10. Explain why a chemical such as DDT can become an ecological problem.

DDT is a pesticide that is absorbed into the fat of primary consumers. DDT is then passed onto higher level consumers causing the concentration to increase and killing off these consumers.

11. What is biological magnification? Which organism in a typical food chain would have the greatest concentration of toxin?

Biomagnification is the process of toxins passing through a food chain. The top carnivore would have the greatest concentration of toxins.

12. __Producers__ give off oxygen and use up carbon dioxide.

a. Producers   b. Consumers   c. Decomposers   d. Combustion

13. What percent of the Earth's atmosphere is oxygen?

22%

14. What percent of the Earth's atmosphere is nitrogen?

78%

15. What are the two major parts of the carbon cycle?
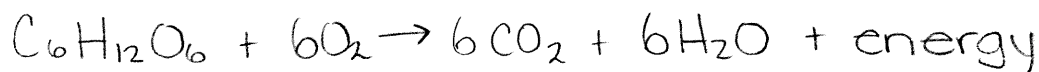
Cellular respiration   Decomposition
photosynthesis   OR   Combustion

16. Write the chemical equation for photosynthesis.

$$6CO_2 + 6H_2O + energy \rightarrow C_6H_{12}O_6 + 6O_2$$

17. Write the chemical equation for cellular respiration.

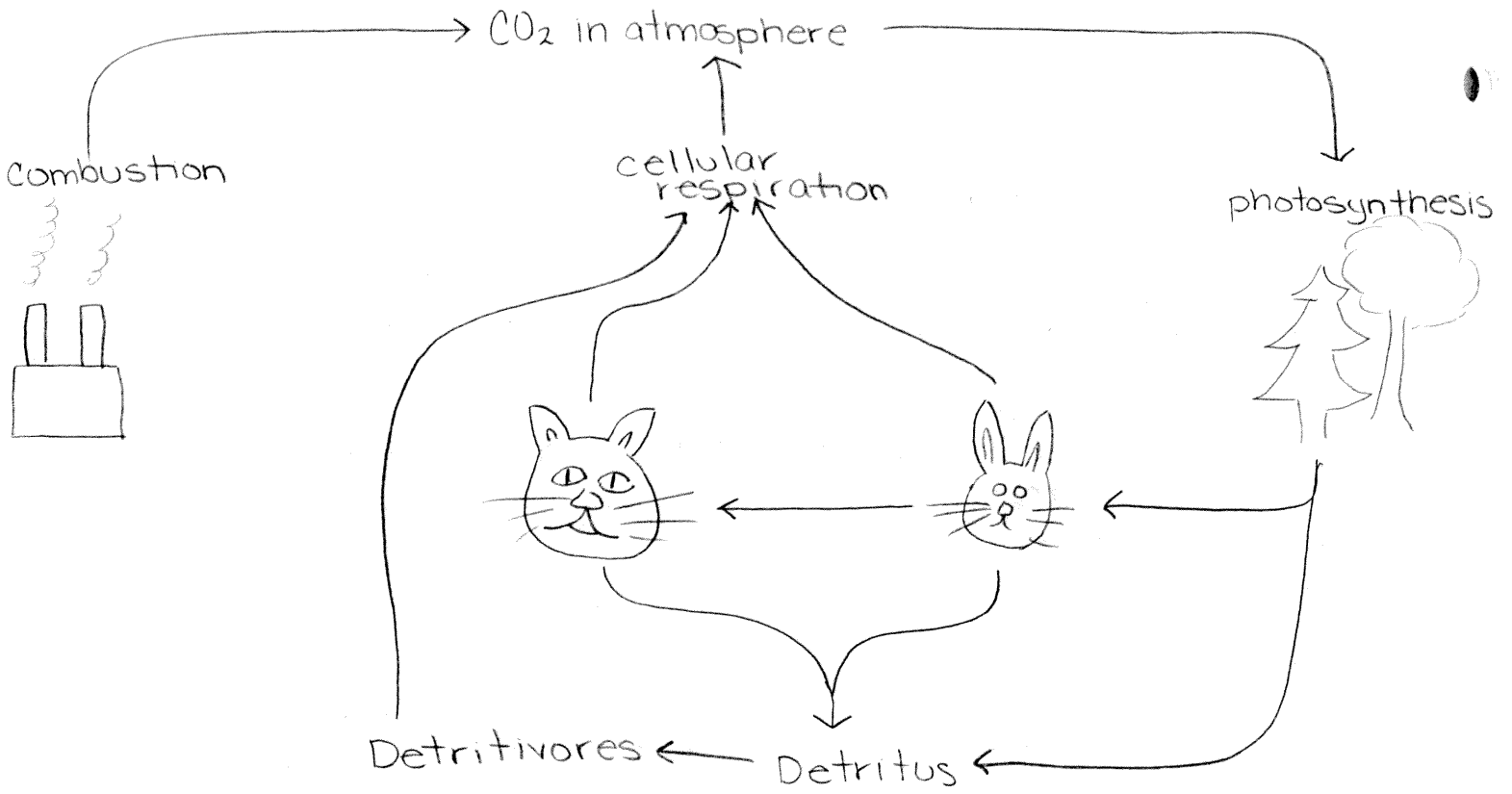$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + energy$$

18. What are the reactants and products of cellular respiration?
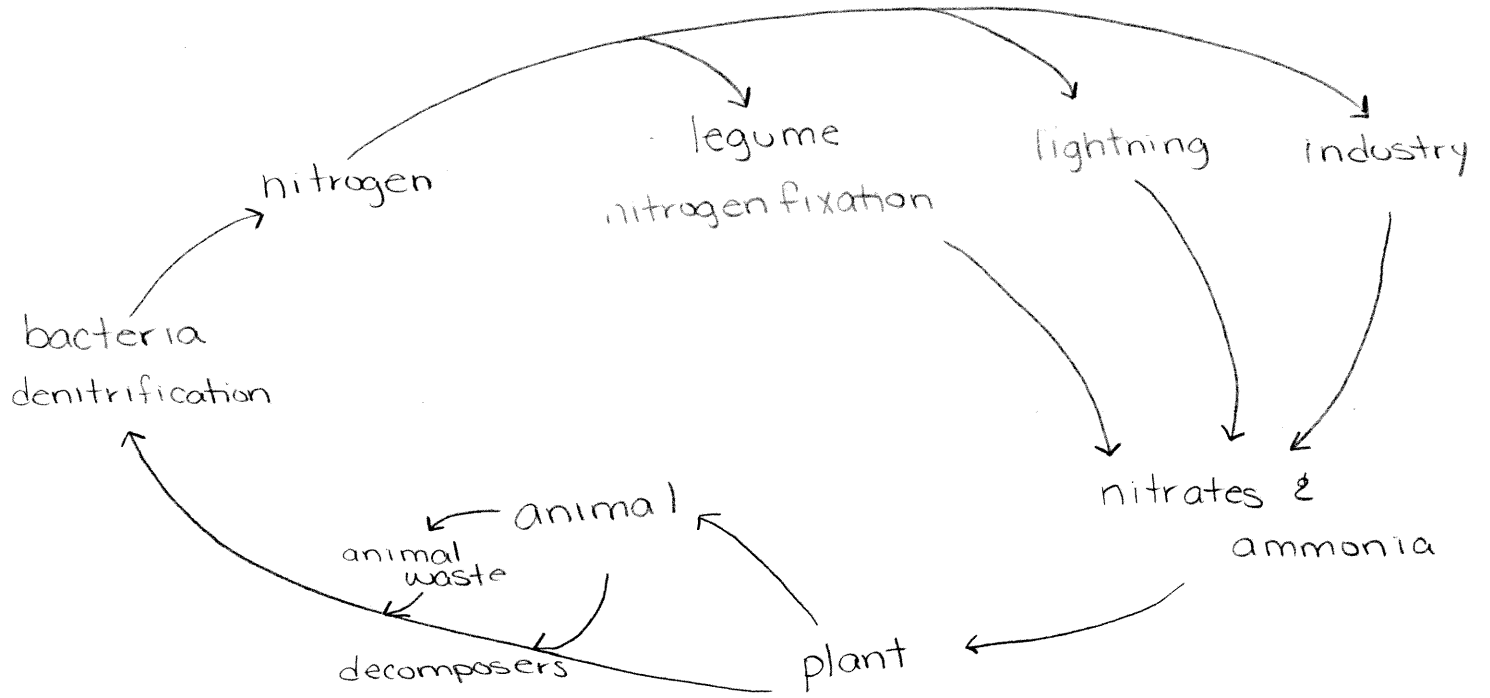
Reactants → glucose and oxygen
Products → carbon dioxide, water and energy

19. ***Know all parts o f the nitrogen and carbon cycles***

20. Draw a *detailed* diagram o f the carbon cycle below:

CO_2 in atmosphere

Combustion

cellular respiration

photosynthesis

Detritivores ← Detritus ←

21. Draw a *detailed* diagram of the nitrogen cycle below:

legume
nitrogen fixation

lightning

industry

nitrogen

bacteria
denitrification

nitrates &
ammonia

animal

animal
waste

decomposers

plant

22. In the nitrogen cycle, specialized bacteria break down nitrogen compounds and release what? What are these specialized bacteria called?

23. Explain how photosynthesis and cellular respiration are opposite processes.

Reactions are opposite to each other
Photosynthesis produces O_2 while
cellular respiration produces CO_2.

24. One specific example of a commonly used chemical in agriculture that interferes with an ecosystem is _fertilizer_ .

25. Why would a wise farmer practice crop rotation and plant legumes in part of his field?

Various crops use different amounts of nitrogen.
Planting legumes increases the amount of nitrogen
in soil. Rotating legumes and other crops keeps
the nitrogen levels balanced

26. An increase in CO_2 levels will cause average global temperatures to _increase_

27. Why are carbon dioxide levels higher in a city than in a forest?

There are less trees in a city to use
the CO_2 in photosynthesis.

28. How does fossilized carbon re-enter the carbon cycle?

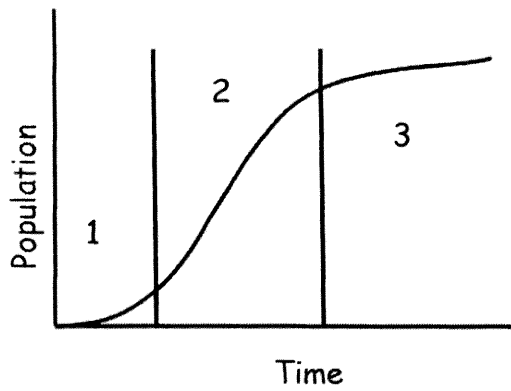Cars burning gasoline producing CO_2.

29. List *several* human activities that release carbon into the atmosphere.

Burning fossil fuels
Breathing
Deforestation (keeps CO_2 in cycle)

30. Briefly describe what is happening to the population in each section of the graph:

i.) Population starts to increase

ii.) Population rate increases

iii.) Population rate decreases

31. Which part of the graph best describes the human population at this moment?

Part 2

32. Define Biodiversity. Explain how the biodiversity o f an ecosystem contributes to its sustainability. Use an example to support your explanation.

Biodiversity is the variety of organisms found within an ecosystem.

Stable and healthy ecosystems will have a large number and variety of species. For an ecosystem to be sustainable, it needs to be renewable and can continue without the addition of new material.

UNIT 2 - Chemistry in Action

Structure of an Atom

o   *You may be asked short answer and fill-in-the-blank questions about the structure of the atom.*

o   *You should know about protons, neutrons, electrons, atomic number, mass number, atomic mass, energy levels, valence electrons, and isotopes*

o   *You may he asked to draw a Lewis dot diagram (electron dot diagram) of an atom.*

o   *You may be asked to draw a Bohr diagram of an atom*

1. What is an element?

    A material that can not be broken down. It consists of protons, neutrons and electrons

2. What are neutrons and where are they found in the atom?

    Subatomic particle found in the nucleus that has mass but no charge.

3. The mass number of an atom always indicates the total number of protons and neutrons.

4. All atoms in a given sample of an element contain the same number of protons and electrons which is also equal to the atomic number.

5. An atom that contains 8 protons. 8 electrons and 9 neutrons has an atomic number of 8 and an atomic mass of 17.

6. An element whose atoms each contain 47 p⁺ , 60 n⁰, and 47 e⁻ has an atomic number of 47 and an atomic mass of 107.

7. Which part of the atom contains most of the atoms total mass?

   The nucleus

8. Draw an electron dot diagram of a sulfur atom

9. An atom has an atomic number of 11 and a mass number of 23.

    a. Name the three types of subatomic particles that make up the atom. Give the proper abbreviation and indicate what type of charge each particle has. Indicate how many of each kind of particle are present in the atom given.

Particle	Abbreviation/Charge	How many?
Electron	e^-	11
Neutron	n^o	12
Proton	p^+	11

    b. Draw a Bohr diagram to show the structure of this atom. Show the numbers and locations of each subatomic particle.
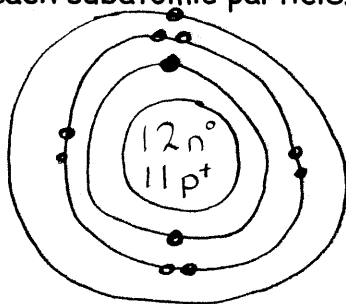
10. Draw a Bohr diagram of a nitrogen atom.
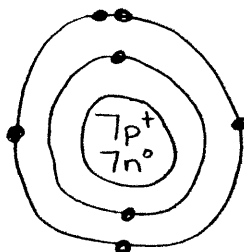
Periodic Table

o *You may be asked some short answer or true and false questions concerning families, periods, valence, metals, non-metals, atomic number, and atomic mass.*

11. Why do the elements **K** and **Na** have similar chemical properties?

    Same amount of valence electrons

12. How are the elements in the modern Periodic Table arranged?

    Arranged in periods and groups with increase in number of electrons. Each group has similar properties and same number of valence electrons.

13. Complete the following table:

Element	Atomic Number	Atomic Mass	Protons	Neutrons	Electrons
Mg	12	24.31	12	12	12
Ag	47	108	47	61	47
As	33	74.92	33	42	33

14. How many periods does the periodic table have? How many groups does the periodic table have?

Periods = 7

Groups = 18

15. Where are the metals found in the periodic table? Where are the non-metals found in the periodic table?

Metals = left / middle

Non-metals = right

16. Which elements are found around the "staircase" of the periodic table? Why are these elements at the "staircase" special?

Metalloids — behave as both metals and non-metals

17. Which metal is a liquid at room temperature?

Mercury (Hg)

18. What does the atomic number represent?

Represents the number of protons in an atom

19. What does the atomic mass represent?

The number of protons and neutrons in an atom.

20. Write the full name of the element beside each symbol.

Symbol	Element name	Symbol	Element name
Cl	chlorine	Ca	calcium
C	carbon	Mg	magnesium
Ne	neon	Si	silicon
N	nitrogen	S	sulfur
He	helium	P	phosphorus

21. What are three ways that an atom can acquire a valence shell like the valence shell of its closest noble gas?

Gain e^-

Lose e^-

Share e^-

Molecules and Compounds

o *You will he asked to draw a Bohr diagram for a covalent molecule such as NH_3, H_2O, CO_2, H_2, and O_2.*

o *Given a formula, you should be able to tell if it is ionic or covalent and tell me how you know.*
  Example: NaOH, or CO_2

  NaOH – ionic

  CO_2 – covalent

o *Given a formula for a covalent molecule, draw a Lewis dot diagram for the molecule.*
  Example: H_2O

  H $^x_.$ O $^._x$ H
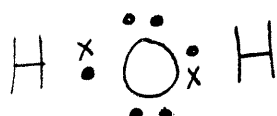
22. What is a cation?
    Positively charged ion

23. What is an anion?
    Negatively charged ion

24. What is the difference between a neutral calcium atom (Ca) from an ion of calcium (Ca^{2+})?

Ca^{2+} has a charge because it has lost $2e^-$. Ca is neutral and has all its electrons

25. In your own words, define the term "ionic compound".

Metal and non-metal. Metal loses e^- and non-metal gains e^-

26. Give three examples of ionic compounds.

HCl, NaOH, HCl, KBr, $MgCl_2$, etc.

27. In your own words, define the term "ionic bond".

Positively charged ion is attracted to a negatively charged ion.

28. Which elements would most likely form an ionic bond with chlorine? (list at least 3)

H, K, Na, Mg, Li, Be, etc.

29. In your own words, define the term "covalent bond".

Bond sharing 2 e^- between 2 non-metals.

30. Are the electrons in a bond between two iodine atoms (I_2) covalent or ionic? How can you tell?

Covalent, valence e^- are shared.
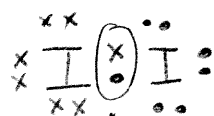
covalent bond
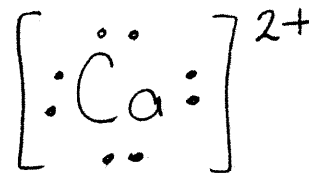
31. Draw the electron dot diagram for each *ion* below,

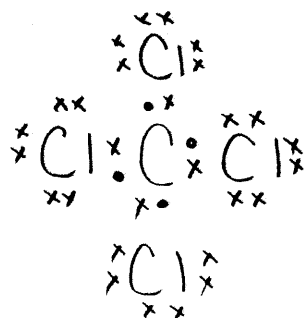   a. Cl^- b. K^+ c. Ca^{2+}
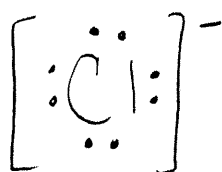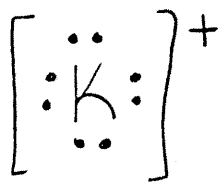
$$\left[:\overset{\cdots}{\underset{\cdots}{Cl}}:\right]^{-} \qquad \left[:\overset{\cdots}{\underset{\cdots}{K}}:\right]^{+} \qquad \left[:\overset{\circ\,\circ}{\underset{\circ\,\circ}{Ca}}:\right]^{2+}$$

32. Draw the Bohr model (covalent bonds) for:

   a. Carbon tetrachloride   b. Water

$$\underset{\overset{\displaystyle Cl}{\displaystyle Cl : C : Cl}}{\overset{\displaystyle Cl}{}} \qquad\qquad H \times O \times H$$
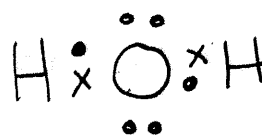
33. Which is the correct electron-dot diagram for a hydrogen molecule?

   a. H·   b. H :   c. H·H   (d.) H : H

34. Complete the following table:

	Compound Formula	Compound Name	Ionic or Covalent?
Magnesium and Chlorine	$MgCl_2$	magnesium chloride	ionic
Sulfur and Oxygen	SO_2 / SO_3	sulfur dioxide sulfur trioxide	covalent
Ammonium and Phosphate	$(NH_4)_3 PO_4$	ammonium phosphate	ionic

35. Name all of the diatomic elements.

   H_2 hydrogen Br_2 bromine

   O_2 oxygen I_2 iodine

   F_2 fluorine N_2 nitrogen

                        Cl_2 chlorine

36. Write the chemical symbol for each of the following *positively charged ions* (cations):

   a. Sodium $\underline{Na^+}$

   b. Calcium $\underline{Ca^{2+}}$

   c. Lithium $\underline{Li^+}$

   d. Barium $\underline{Ba^{2+}}$

   e. Zinc $\underline{Zn^{2+}}$

   f. Mercury(I) $\underline{Hg^+}$

   g. Tin(II) $\underline{Sn^{2+}}$

   h. Tin(III) $\underline{Ti^{3+}}$

37. Write the chemical symbol for each of the following *negatively charged ions* (anions):

   a. Fluoride $\underline{F^-}$

   b. Nitride $\underline{N^{3-}}$

   c. Sulfide $\underline{S^{2-}}$

   d. Oxide $\underline{O^{2-}}$

   e. Bromide $\underline{Br^-}$

   f. Iodide $\underline{I^-}$

38. How many different elements are found in the following compounds?

   a. a. KOH | b. $NaClO_3$ | c. Al_2S_3 | d. $Bi(NO_3)_3$

   a.
   1 K
   1 O
   1 H

   b.
   1 Na
   1 Cl
   3 O

   c.
   2 Al
   3 S

   d.
   1 Bi
   3 N
   9 O

Formulas

o Given the name of an ionic compound, write the formula using the polyatomic ion table to get charges and the cross-over method, or given the formula, write the name.

Example: Calcium Hydroxide $\underline{Ca^{2+} \ OH^- \Rightarrow Ca(OH)_2}$

Example: Na_3PO_4 $\underline{sodium \ phosphate}$

o Given an ionic formula where the metal can have more than one possible charge (as shown on your common ion table or periodic table), use the stock system to name the compound using appropriate Roman numerals

Example: $Fe(NO_3)_3$ $\underline{iron \ (III) \ nitrate}$

o Write names or formulas for covalent molecules using appropriate prefixes.

Example: N_2O_5 $\underline{dinitrogen \ pentaoxide}$

Example: Sulfur trioxide $\underline{SO_3}$

39. In a sentence or two, sum up the Law of Conservation of Mass.

Matter can not be created or destroyed. Amount of reactants/products have to be balanced.

40. Write the formulas for the following ionic compounds.

a. lithium sulfide $\underline{Li_2S}$ f. iron (II) nitride $\underline{Fe_3N_2}$

b. calcium chloride $\underline{CaCl_2}$ g. iron (III) oxide $\underline{Fe_2O_3}$

c. potassium nitride $\underline{K_3N}$ h. copper (I) chloride $\underline{CuCl}$

d. zinc chloride $\underline{ZnCl_2}$ i. copper (II) oxide $\underline{CuO}$

e. sodium carbide $\underline{Na_4C}$
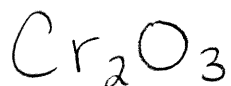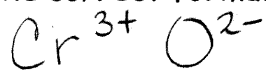
41. Write the names for the following binary ionic compounds.

   a. MgO   magnesium oxide

   b. K_2O potassium oxide

   c. $BeCl_2$ beryllium chloride

   d. Al_2S_3 aluminum sulfide

   e. $AlCl_3$ aluminum chloride

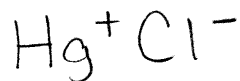   f. Cu_2O copper (I) oxide

   g. CuO   copper (II) oxide

42. What is the correct name for Fe_2O_3?

   iron (III) oxide

43. What is the correct formula for chromium (III) oxide?

   $Cr^{3+} O^{2-}$

   Cr_2O_3

44. Give the formula that represents mercury (I) chloride.

   $Hg^+ Cl^-$

   $HgCl$

45. Match each description in column A with the correct term in column B. Write the letter for the term on the line beside the description.

	A	B
E 1.	positively charged ion	a) atomic number
C 2.	term used by chemists to describe the number of bonds that an atom forms in a compound.	b) periods
D 3.	charged atom	c) valences
G 4.	bonds formed between anions and cations	d) ion
J 5.	bond formed by atoms that share a pair of electrons	e) cation
A 6.	number of protons or electrons in a neutral atom	f) anion
I 7.	neutral particle that is composed of two or more atoms	g) ionic bond
B 8.	horizontal rows of the periodic table	h) diatomic molecule
F 9.	negatively charged atom	i) molecule
H 10.	molecule that contains two atoms	j) covalent bond

46. Give the name of the following compounds:

a. KF   potassium fluoride

b. CO_2 carbon dioxide

c. $(NH_4)SO_4$ ammonium sulfate

d. N_2O_5 dinitrogen pentaoxide

e. NO2   nitrogen dioxide

47. Write the formulas for the following compounds

    a. Sodium chlorate $NaClO_3$

    b. Barium chlorate $Ba(ClO_3)_2$

    c. Calcium nitrate $Ca(NO_3)_2$

    d. Barium sulfate $BaSO_4$

    e. Ammonium phosphate $(NH_4)_3PO_4$

    f. Copper (I) carbonate Cu_2CO_3

    g. Iron (III) nitrate $Fe(NO_3)_3$

    h. Sodium chloride $NaCl$

    i. Nickel (II) bromide $NiBr_2$

    j. Trinitrogen pentoxide N_3O_5

48. Which types of elements combine to form ionic compounds?

Metals and non-metals

49. Which types of elements combine to form molecular (covalent) compounds?

Non-metals

50. Write the names for the following binary ionic compounds:

   a. $ZnSO_4$ zinc sulfate

   b. $Al(NO_3)_3$ aluminum nitrate

   c. $(NH_4)_2SO_4$ ammonium sulfate

   d. $Zn(OH)_2$ zinc hydroxide

   e. $Pb(NO_3)_4$ lead (IV) nitrate

   f. Cu_3PO_4 copper (I) phosphate

   g. $Cu_3(PO_4)_2$ copper (II) phosphate

51. Give the chemical formula for each of the following:

   a. sulfur dioxide SO_2

   b. carbon dioxide CO_2

   c. dibromine pentachloride Br_2Cl_5

   d. triuranium octaoxide U_3O_8

   e. bromine monochloride $BrCl$

   f. sulfur hexafluoride SF_6

   g. chlorine tetrafluoride ClF_4

   h. dichlorine heptoxide Cl_2O_7

52. Give the chemical names for each of the following:

a. N_2O_4 dinitrogen tetraoxide

b. SiO_2 silicon dioxide

c. P_2O_5 diphosphorus pentaoxide

d. CCl_4 carbon tetrachloride

e. BrF bromine monofluoride

f. BF_3 boron trifluoride

g. $SeBr_2$ Selenium dibromide

Chemical Equations

o *Given an equation, state which substances are reactants and which are products.*

Example: $2Na + 2H_2O \rightarrow 2NaOH + H_2$
reactants   products
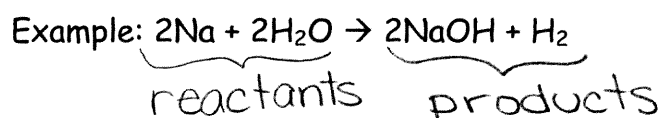
o *Given an equation, be able to balance*

Example: $\underline{2}\,Na + \underline{}Cl_2 \rightarrow \underline{2}\,NaCl$

o *Given word equations, be able to give the balanced equation.*

Example: Sodium metal plus chlorine gas reacts to produce sodium chloride.

$$2Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$$
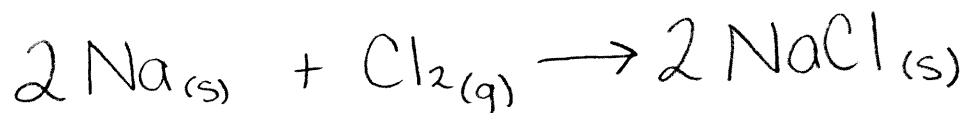
o   *Be able to classify a reaction as either endothermic or exothermic if it includes the energy component.*

53. What is the difference between an endothermic reaction and an exothermic reaction?

endo - absorb energy
exo - release energy

54. H_2SO_3 + thermal energy $\rightarrow$ SO_2 + H_2O Answer: __endo__

o   *Know the general formulas for synthesis, decomposition, single displacement, double displacement reactions, or combustion.*
o   *Given balanced equations classify the type of reaction.*

Example: $3P_2O_5$ + $9H_2O$ $\rightarrow$ $6H_3PO_4$ Answer: __synthesis__.

o   *Given the reactants and type of reaction, complete the equation and balance.*

Example: __2__ Al + __3__ I_2 $\rightarrow$ $2\ AlI_3$ synthesis

Example: _____ BeF_2 + _____ K_2O $\rightarrow$ BeO $+2KF$ double displacement

55. Balance each skeleton equation on the line provided.

   a. __2__ Ca + _____ O_2 $\rightarrow$ __2__ CaO
   b. _____ CH_4 + __4__ Cl_2 $\rightarrow$ _____ CCl_4 + __4__ HCl
   c. __2__ NO + _____ O_2 $\rightarrow$ __2__ NO_2
   d. __4__ Al + __3__ O_2 $\rightarrow$ __2__ Al_2O_3
   e. __2__ Fe + __3__ Cl_2 $\rightarrow$ __2__ $FeCl_3$
   f. __2__ $KClO_3$ $\rightarrow$ __2__ KCl + __3__ O_2
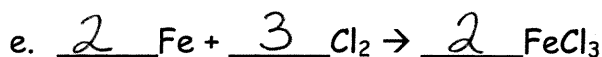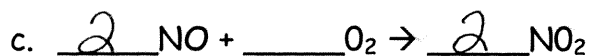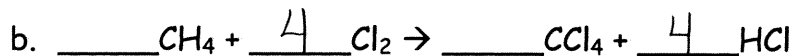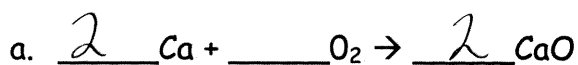
56. For each equation:
    a. Balance it.
    b. Identify the type of reaction

    i. 2 $NO_{(g)}$ + _____ $O_{2(g)}$ → 2 $NO_{2\ (g)}$ S

    ii.   _____ $FeS_{(s)}$ + 2 $HCl_{(aq)}$ → _____ $FeCl_{2\ (aq)}$ + _____ $H_2S_{(g)}$ DD

    iii. 4 $Al_{(s)}$ + 3 $O_{2(g)}$ → 2 $Al_2O_{3(s)}$ S

    iv. 2 $Ca(OH)_{2(s)}$ → 2 $Ca_{(s)}$ + 2 $H_2O_{(l)}$ + _____ $O_{2(g)}$ D
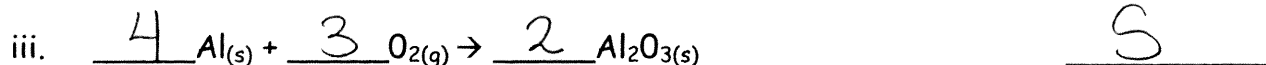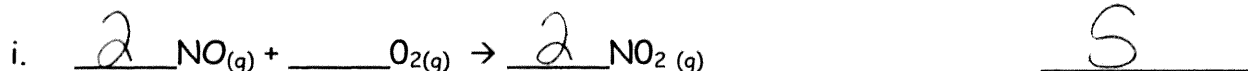
57. Write the balanced equation for the following:
    a. sodium + chlorine → sodium chloride

$$2Na + Cl_2 \rightarrow 2NaCl$$
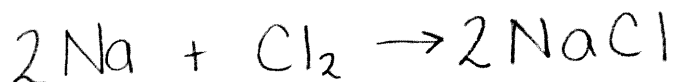
    b. Iron(II) oxide → iron + oxygen

$$2FeO \rightarrow 2Fe + O_2$$
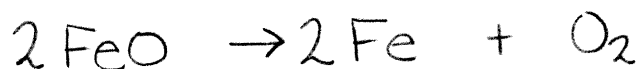
    c. cupric oxide → copper + oxygen

$$2CuO \rightarrow 2Cu + O_2$$
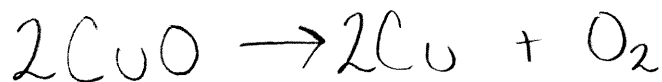
Acids and Bases
  ○ *Know the properties of an acid, base, and salt.*
  ○ *Be able to answer questions on indicators.*

    Example: Bromothymol blue turns yellow in a solution. The solution is therefore a/an   acid .

  ○ *pH questions:*
    Example: A solution has a pH of 3, it is therefore classified as   acid .

○ *Neutralization - Given an acid and a base determine the formula of the salt and show the water. Balance the equation.*

Example: _____H_2SO_4 + __2__NH_4OH → $2H_2O$ + $(NH_4)_2SO_4$
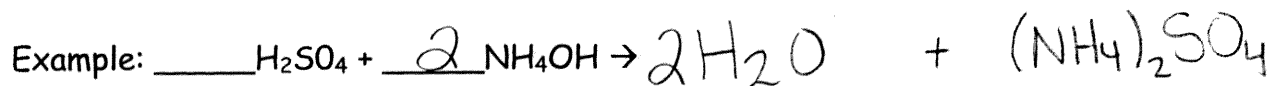
58. pH of 7 means a solution is __neutral__

pH of 0-6 means a solution is __acidic__

pH of 8-14 means a solution is __basic__

59. On this pH scale, indicate where to place a weak acid, weak base, strong base, and strong acid.

0 __strong acid__ __weak acid__ 7 __weak base__ __strong base__ 14

60. Phenolphthalein is a/an __indicator__ .

61. Name 2 properties of acids.
  - taste sour
  - burns

62. Name 2 properties of bases.
  - taste bitter
  - feels slippery

63. The pH of a solution is found to be 3.6. What does this mean? Compare this solution with a solution having a pH of 9.5.
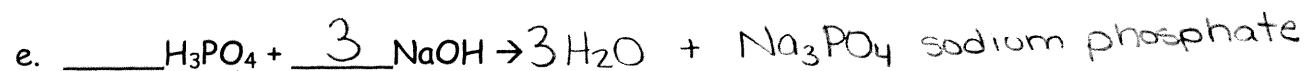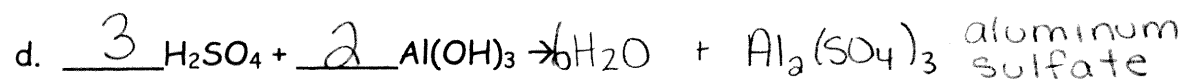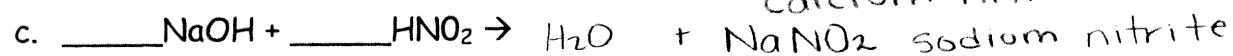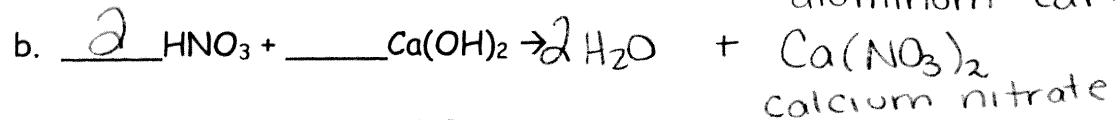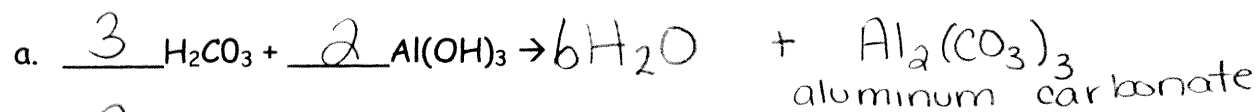 A solution with pH 3.6 is acidic
  A solution with pH 9.5 is basic

64. What type of reaction is a neutralization reaction?
  Double displacement
  ACID + BASE → SALT + WATER
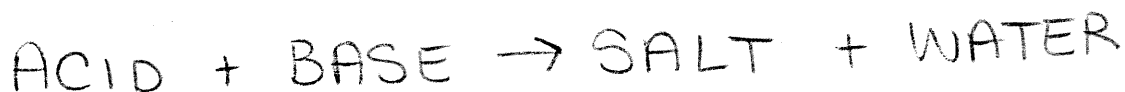
65. Neutralization equations: Complete, balance and name the salt.

a. __3__ H_2CO_3 + __2__ $Al(OH)_3$ → $6 H_2O$ + $Al_2(CO_3)_3$
aluminum carbonate

b. __2__ HNO_3 + _____ $Ca(OH)_2$ → $2 H_2O$ + $Ca(NO_3)_2$
calcium nitrate

c. _____ $NaOH$ + _____ HNO_2 → H_2O + $NaNO_2$ sodium nitrite

d. __3__ H_2SO_4 + __2__ $Al(OH)_3$ → $6 H_2O$ + $Al_2(SO_4)_3$ aluminum sulfate

e. _____ H_3PO_4 + __3__ $NaOH$ → $3 H_2O$ + Na_3PO_4 sodium phosphate

f. _____ $Ca(OH)_2$ + __2__ HCl → $2 H_2O$ + $CaCl_2$ calcium chloride

g. _____ H_2SO_4 + _____ $Fe(OH)_2$ → $2 H_2O$ + $FeSO_4$ Iron (II) sulfate
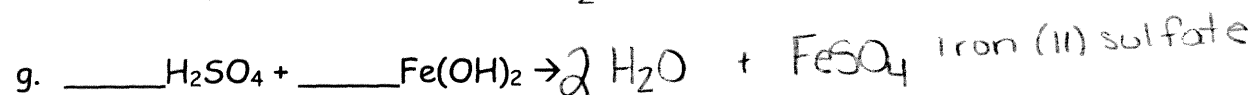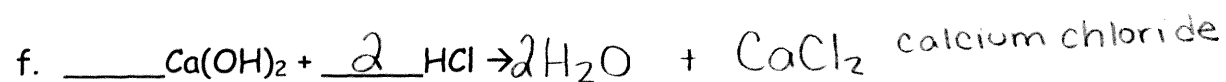
UNIT 3 - In Motion

1. The slope of a distance-time graph is the _velocity /speed_ of an object.

2. Sketch a distance-time graph of a cart rolling down an inclined ramp, starting from a stopped position until it reaches the bottom o f the ramp.
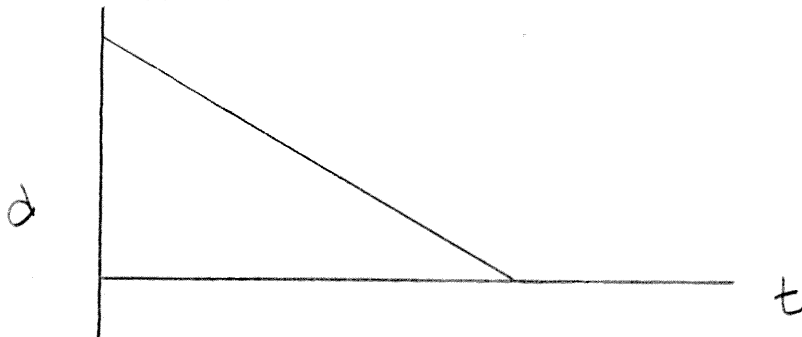
3. Explain how to calculate:
   a. Position: _location of object in relation to the reference point_
   b. Displacement: $\vec{\Delta d} = \vec{d_f} - \vec{d_i}$
      The distance between the intial and final position
   c. Velocity: $\vec{v} = \Delta d / \Delta t$ _How fast an object's position is changing_

4. What is a vector?

   Vector represents a quantity that has magnitude and direction.

5. Which of the following are scalar quantities, and which are vector quantities:

   a. Position: _vector_

   b. Distance: _scalar_

   c. Displacement: _Vector_

   d. Speed: _scalar_

   e. Velocity: _vector_

   f. Acceleration: _vector_

6. The rate of change of displacement is known as __velocity__ and the rate of change of velocity is known as __acceleration__.

7. Indicate which of the following three position-time graphs shows an object that is moving in a positive direction, in a negative direction or standing still.

A)

-ve direction

B)

+ve direction

C)

standing still
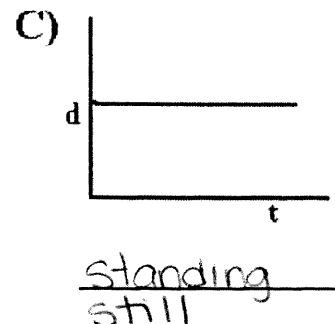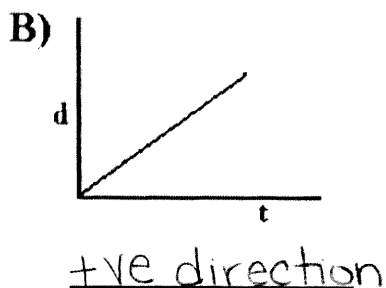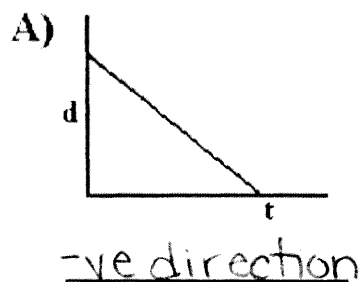
8. Does the graph below
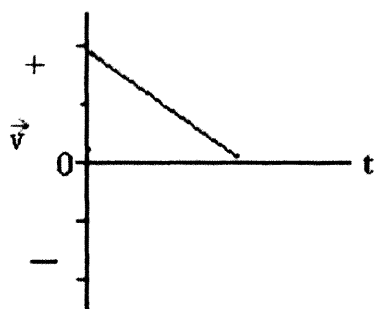
a. Show an object that is speeding up, slowing down or moving at a constant speed?

Slowing down

b. Is the object moving left or right (where + is right)?

Right

9. Describe the difference between displacement and distance.

Displacement - distance between initial and final position.

Distance - total amount of the journey from start to finish

10. Describe the difference between average and instantaneous velocity.

Average velocity is the displacement over time

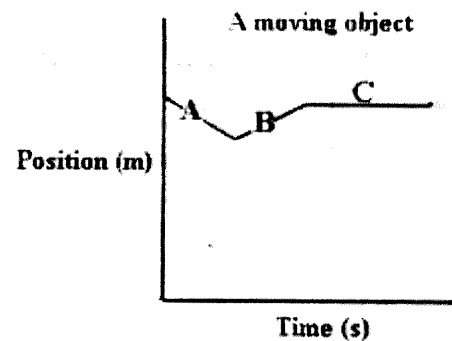Instantaneous velocity is the velocity at a specific time

11. From the following distance-time graph at what part of the graph is the object

     a. Not moving?

          C

     b. Heading back to the origin?

          A

A moving object

Position (m)

Time (s)

12. Which of the following represent uniform motion?
    a. A car standing still
    b. A car backing up at 5 km/h
    c. A runner in a 100 m sprint
    d. A football that has just been thrown for 50 yards.

13. Using Newton's first law, describe the second collision in a car crash.

It occurs after the vehicle has stopped but your body is still in motion. Your body will continue forward until it hits the steering wheel, air, etc, which causes you to stop.

14. Using Newton's second law, describe the difference between a car striking a small picket fence and a car striking a big tree. $F = ma$

The picket fence has less mass then a tree. The tree would exert more force on the car causing more damage then the fence.

15. Describe the energy changes that occur in a car crash using the law of conservation of energy to help explain.

While moving the car has kinetic energy. Once stopped, the kinetic energy has been transferred to sound and heat energy. Energy can not be destroyed, but transferred to other forms.

16. Give the relationship between something flying out the front windshield and the speed of the car in a collision.

The faster you are moving, the more momentum you have. The more momentum, the greater the impulse needed to stop

↑ velocity , ↑ in distance of flying from windshield

17. Two vehicles are traveling toward each other. Vehicle A has a mass o f 3000 kg and is traveling at 50 km/h to the right. Vehicle B has a mass of 2500 kg and is traveling at 60 km/h to the left.

$50 \text{ km/h} \div 3.6 = 13.89 \text{ m/s}$
$60 \text{ km/h} \div 3.6 = 16.67 \text{ m/s}$

a. Which vehicle has the greater momentum? $P = mV$

A: $P = (3000 \text{ kg})(13.89 \text{ m/s}) = 41670 \text{ kg m/s}$

B: $P = (2500 \text{ kg})(16.67 \text{ m/s}) = 41675 \text{ kg m/s}$

Car B has greater momentum

b. Describe the energy changes that occur during the collision.

Kinetic energy transfers to other forms of energy such as sound energy (crashing) and heat energy (smoke from engine)

18. A student is moving at + 20 m/s. 10 seconds later the student is moving at 0 m/s. What is the average acceleration of the student?

$$a = \frac{V_f - V_i}{t} = \frac{0 - (20)}{10} = -2 \text{ m/s}^2$$

19. An object has a speed of 18 km/h. The speed of the object in m/s is:

$$18 \text{ km/h} \div 3.6 = 5 \text{ m/s}$$

20. If a car is traveling at an average speed of 50 kilometers per hour, how long does it take to travel 12 kilometers?

$$V = \frac{d}{t} \qquad 50 = \frac{12}{t} \qquad t = 0.24 \text{ hr} \quad (14.4 \text{ min})$$

21. The average velocity of an object during 7.0 seconds is 2 meters per second. What is the total distance traveled by the object?

$$V = \frac{d}{t} \qquad 2 = \frac{d}{7.0} \Rightarrow d = 14 \text{ m}$$

22. What is the average speed of an object that moves 6.0 meters in 9.0 seconds?

$$V = \frac{d}{t} = \frac{6.0 \text{ m}}{9.0 \text{ s}} = 0.67 \text{ m/s}$$

23. Acceleration represents the rate of change in __velocity__.

24. Momentum is a quantity that depends on __mass__ and __velocity__.

25. A child runs in front of a car which is moving at 13 m/s. It takes the driver 0.65 s to react before stepping on the brakes. How far does the car travel before it begins to stop?

$$d = vt = (13)(0.65) = 8.45 \text{ m}$$

26. A boat travels 2.5km South on a river, turns and travels 5.25 km North. What is the boat's displacement? Make sure to include the direction.

$$d_i = 2.5 \text{ km [S]} \qquad d_f = 5.25 \text{ km [N]}$$

$$\Delta d = d_f - d_i$$
$$= 5.25 - 2.5$$
$$= 2.75 \text{ km [N]}$$

27. Which type of graph will allow you to determine the location of an object?
   a.) Distance-time graph
    b. Velocity-time graph

28. Define each of Newton's laws of motion and give an example of each.
    1) Object at rest stays at rest, object in motion stays in motion unless acted on by an external force. Ex seatbelt stopping you in a collision

    2) Force is related to mass and acceleration (F=ma) Ex moving a piano requires more force than moving a piano bench

    3) For every action there is an equal and opposite reaction. Ex walking = you push on the ground, ground pushes back
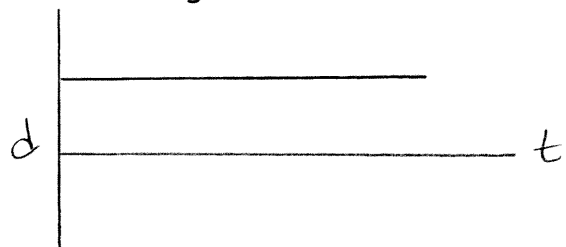
29. True or False: Slowing down is an example of acceleration.

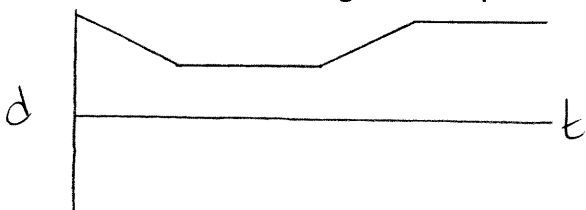30. Sketch a position-time graph for each description:
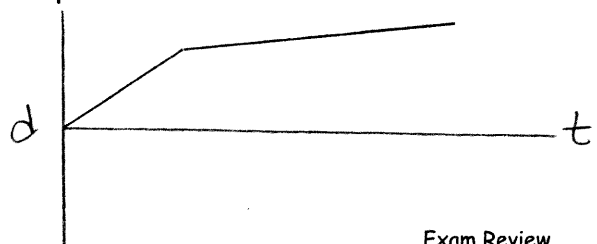   a. Moving forward in a uniform motion (constant speed)
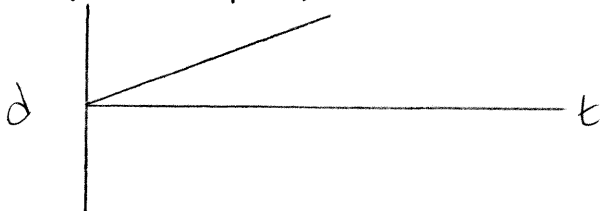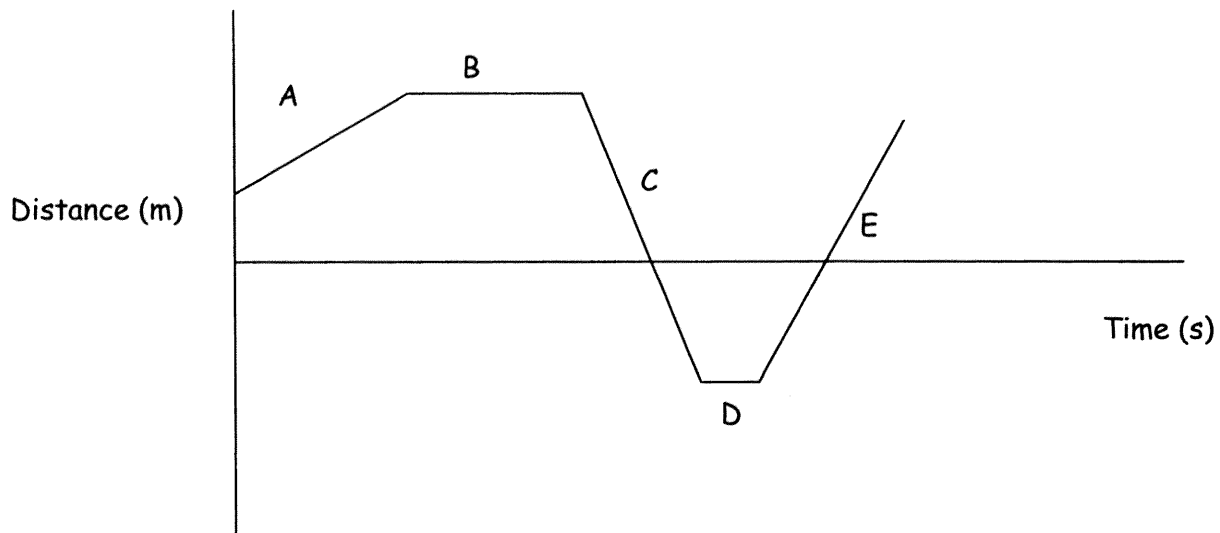

    c. Not moving

    b. Moving backward at a constant speed, stopping, accelerating forward, and coming to a stop.

    d. Moving forward at a constant speed, then moving forward at a slower speed.

31. Describe the motion during each segment of the graph.

A: Object is moving at constant speed

B: Object is stopped

C: Object is moving at constant speed in opp. direction

D: Object is stopped

E: Object is moving at a constant speed

32. Calculate the impulse if a baseball bat exerts a force o f 150 N on a baseball during the 0.03 s they are in contact.

$I = Ft = (150 N)(0.03s) = 4.5 Ns$

33. How long would a 96 Ns impulse be applied if the average force of a Hot Wheels™ car is 30 N forward?

$I = Ft$ $96 Ns = (30N) t$ $t = 3.2 s$

34. A car is traveling at 30 m/s along an icy road when a deer darts onto the road. If the "k" value of ice is 0.25, what distance is required for the car to stop once the brakes are applied?

$$d = kv^2 = (0.25)(30 \text{ m/s})^2 = 225 \text{ m}$$

35. A car traveling on dry pavement (k = 0.06) applies the brakes and comes to a complete stop after 60 m. What speed was the car traveling?

$$d = kv^2$$
$$60 \text{ m} = (0.06)v^2$$
$$\sqrt{v^2} = \sqrt{1000}$$
$$v = 31.62 \text{ m/s}$$

36. Calculate the *total stopping distance* of a car traveling at 80 km/h on wet pavement (k = 0.1) if the driver's reaction time is 0.90 seconds.

$$80 \text{ km/h} \div 3.6 = 22.22 \text{ m/s}$$

Braking distance $= kv^2 = (0.1)(22.22)^2 = 49.37 \text{ m}$

Reaction distance $= vt = (22.22)(0.90) = 20.00 \text{ m}$

Total Stopping $= 20.00 + 49.37 = 69.37 \text{ m}$