**Science 10 Review**

**Tips for Studying:**

* **Take responsibility for yourself**  
  Recognize that in order to succeed you need to make decisions about your priorities, your time, and your resources.
* **Center yourself on your values and principles**  
  Don't let friends and acquaintances dictate what you consider important.
* **Put first things first**  
  Follow up on the priorities you have set for yourself, and don't let others, or other interests, distract you from your goals.
* **Discover your key productivity periods and places**  
  Morning, afternoon, or evening?  
  Find spaces where you can be the most focused and productive.  Prioritize these for your most difficult study challenges.
* **Consider yourself in a win-win situation**  
  when you contribute your best to a class, you, your fellow students, and even your teacher will benefit. Your grade can then be one additional check on your performance.
* **Look for better solutions to problems**  
  For example, if you don't understand the course material, don't just re-read it. Try something else! Consult with the professor, a tutor, an academic advisor, a classmate, a study group, or your school's study skills center
* **Look to continually challenge yourself**

**THIS NOTE PACKAGE IS JUST THE BARE BONES! IT IS YOUR RESPONSIBILITY TO KNOW EACH TOPIC IN GREATER DETAIL!**

.**CHEMISTRY**

* WHMIS – Workplace Hazardous Materials Information System; symbols used to identify dangerous materials
* Classifying Matter – matter is anything with mass and volume and could

be either solid liquid or gas. Matter can be further divided into either a mixture or a pure substance.

* Atomic Theories –Early Chemists devised theories about the structure of an “atom”.
  + Dalton’s Atomic Theory: **billiard ball**
    - All matter is made up of small particles called atoms
    - Atoms cannot be created, destroyed or divided into smaller parts
  + J.J. Thomson: **raison bun**
    - Thought atoms might be made up of smaller particles
    - Proved that negatively charged *electrons* were part of an atom using cathode ray tube
    - Viewed atom as a “raisin bun”
  + Rutherford: **planetary model**
    - Using alpha particle streams showed that positively charged *protons* and neutral *neutrons* existed within an atom’s *nucleus*.
    - A volume of empty space surrounded the nucleus
    - Atomic model looks like a “solar system”
  + Bohr:
    - Thought electrons were associated with certain *energy levels*

|  |  |
| --- | --- |
| **Energy level** | **Maximum # of electrons** |
| 1 | 2 |
| 2 | 8 |
| 3 | 8 |

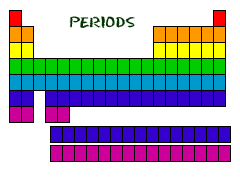
* What element is the drawing of? \_\_\_\_\_\_Al
  + Working Model of the Atom:

|  |  |  |
| --- | --- | --- |
| **Subatomic**  **particle** | **Charge** | **Symbol** |
| Proton | 1 + | p+ |
| Neutron | 0 | n0 |
| electron | 1 - | e- |

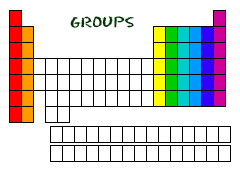


* Nuclear Notation using the periodic table -
  + Atomic Number = number of protons and electrons in an **atom**
  + Mass Number = number of protons + number of neutrons
  + Number of neutrons = mass # - atomic #
* Periodic Table:
  + Organizes elements to help us predict their *properties*
  + Three major sections:
    - Metals - left side
    - Non-metals – right side
    - Metalloids – border the “staircase line” that separates metals and non-metals

.

* Elements are arranged into **periods** (horizontal rows) and **groups** (vertical columns)
* Periods = occupied energy levels.
* Groups – Sometimes called “families”, having the same number of valence electrons (electrons in the outer most shell)

eg. Group 1 is the Alkali Metals (1 valence electron)

Group 2 is the Alkaline Earth (2 valence electrons)

Group 7 is the Halogens (7 valence electrons)

Group 8 is the Nobel gases

* Octet rule– Atoms want their valence shell to be full so they gain or lose electrons so that there are 8 electrons. Uneven numbers of electrons and protons result in a *charge* creating an ion.
* Formation of Ions:
* Positive Ions are called CATIONS – they have *lost* electrons (metals do this)
* Negative Ions are called ANIONS – they have *gained* electrons (non-metals do this)
* **Ionic Compounds** – metal (cation) and non-metal (anion)
* Held together by ionic bonds forming a *crystal lattice* thatresult from a transfer of electrons
* Naming Ionic compounds
* The 1st element in the name and the formula is the metal
* The 2nd element, the non-metal named as an ion (add suffix “-ide” ) fluorine = fluoride
  + - Eg. LiCl \_\_\_\_lithium chloride\_\_\_\_\_\_\_\_\_\_ KBr \_\_\_\_pottasium bromide\_\_\_\_\_\_\_\_\_\_\_ CaCl2 \_\_\_\_\_calcium chloride\_\_\_\_\_\_\_\_\_\_\_
* Writing ionic formulas:
* Use ion charges from you periodic table to decide the charge of each
* Decide how many of each ion is required to create a neutral compound
* If more than one, denote the number with a subscript beside the element symbol

Eg. Potassium Oxide = K+ and O2- we need two potassium to make neutral = K2O (s)

* + - Eg. Potassium sulfide \_\_\_\_\_\_\_\_\_\_ (K2S) Beryllium fluoride \_\_\_\_\_\_\_\_\_\_\_ (BeF2)
* Multivalent Elements -The Stock System:
* Some metals have more than one cation. The stock system determines the charge to use.
* Cation ion charge is written in brackets as a roman numeral after the metal name

Eg. Ni2+ is nickel (II) and Ni3+ is nickel (III)

* Polyatomic Ions:
  + - A group of different atoms joined by a covalent bond with an *overall* charge or + or -.
    - You will find the names, formulas and charges of these on the back of your periodic table
    - To name use the name of the cation followed by the name of the anion – no suffix change

Eg. NO3- is called nitrate. It has an overall charge of 1-. When bonded with Zn2+ we get – Zn (NO3)2 or zinc nitrate

* Acids
  + - An acid contains hydrogen as the cation (the first element in a formula)
    - Name first as an ionic compound and *then* apply the acid rules depending on the result
    - **hydrogen \_\_\_\_ide = hydro\_\_\_\_ic acid** HCl = hydrogen chloride = hydrochloric acid
    - **hydrogen\_\_\_\_­\_ate = \_\_\_\_\_\_\_\_\_ic acid** HClO3 = hydrogen chlorate = chloric acid
    - **hydrogen\_\_\_\_\_ite = \_\_\_\_\_\_\_ous acid** HClO2 = hydrogen chlorite = chlorous acid
* **Molecular Compounds** (non-metal and non-metal)

-Groups of atoms with no charge called *molecules* – not ions

-Atoms of the same element can from bonds so elements can exist as molecules

-Diatomic molecules (aka the flag rule –MEMORIZE!!)

-Elements joined by *covalent* bonds – sharing electrons not exchanging them

* Naming Molecular Compounds: 2 or more non-metals together
* First element in the name is the one farther to the left on the periodic table
* The suffix “-ide” is added to the name of the second element
* *Prefixes* are used to tell how many atoms are of each type are in the molecule

\* *mono* is used only for the 2nd element \*

Eg. CO2 = carbon *di*oxide, CCl4 = carbon *tetra*chloride

* Some molecular compounds do not follow simple naming rules – MEMORIZE them

|  |  |
| --- | --- |
| H2O(l) water | H2O2(1) hydrogen peroxide |
| NH3(g) ammonia | C12H22O11(s) sucrose |
| CH4(g) methane | C3H8(g) propane |
| CH3OH(l) methanol | C2H5OH(l) ethanol |
| C6H12O6(s) glucose | O3(g) ozone |

* Molecular and Ionic compounds have specific properties.
* **Chemical Reactions**
* Occurs when one or more substances change to form different substances
* Substances that undergo change are called *reactants* substance that result are called *products*
* Reactants → Products: all chemical reactions involve a change in energy
* Evidence a chemical reaction has occurred may include:
  + - Energy change
    - Odor Change
    - Color Change
    - Formation of Gas
    - Formation of a solid (Precipitate) in solution
* A precipitate is an insoluble solid formed out of solution. We can predict if a cation and an anion will mix to form a precipitate using the Solubility chart on the back of your periodic table
  + - High Solubility = (aq)
    - Low Solubility = (s)
    - *Everything is soluble if NH4+, NO3-, or Group 1 is involved*
* Reactions release or absorb energy
* Release energy = *exothermic reaction* eg. Combustion of gasoline
* Require energy = *endothermic reaction* eg. Photosynthesis needs the sun’s energy
* The Law of Conservation of Energy states that energy cannot be create or destroyed only transferred. Breaking chemical bond = endothermic; forming new bonds = exothermic.
* Writing Reactions

Arrow means “produce”

Products on right side of arrow

Reactants on left side of arrow

***Zn(s) + AgNO3(aq) Zn(NO3)2(aq) + Ag(s)***

Plus sign means “reacts with”

* **Balanced Equations:**
* There needs to be the same number of atoms on one side of the equation as the other
* Called the *Law of Conservation of Mass*. We use *Coefficients* (big numbers in front of formulas) to balance atoms on either side.

1. Write out formulas for all compounds and elements, add arrow and plus signs if needed
2. Identify unbalanced atoms and polyatomic ions & add coefficients where necessary.
3. Check balancing at the end

* **Types of Reactions**
  + Reactions are classified to help predict the products
* **Formation**– two or more reactants combine to make a new compound (product) A+B→AB
* **Decomposition**– a compound breaks into simpler compounds or elements AB→A+B
* **Single Replacement** – one element replaces another in a compound A + BX → AX + B
* **Double Replacement** – cations & anions exchange partners to form new compounds

AX + BY → AY + BX, these reactions may form a precipitate so check solubility chart

* **Combustion**- contain hydrogen, carbon and oxygen and always result in carbon dioxide and water as your products.

Hydrocarbon + Oxygen Carbon dioxide + Water

* **The Mole** 
  + Avagadro’s number is 6.02 x 1023 – called a **Mole** (symbol **mol**)
  + The atomic molar mass is the average of all the isotopes of a compound.

i.e. carbon has three isotopes: carbon 12 (6 neutrons), carbon 13 (7 neutrons) and carbon 14 (8 neutrons) to give an average of 12.01 g/mol.

* Converting between mass and molar mass can be accomplished by using ratios or the formula:

*n* = *m* / M

* Coefficients of a balanced equation refer to the number of moles of each atom, molecule or formula unit

**Atoms and Ions Review:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Symbol | # protons | # electrons | # neutrons | Charge |
| arsenic atom | As | 33 | 33 | 42 | 0 |
| Chlorine atom | Cl | 17 | 17 | 18 | 0 |
| Antimony ion | Sb5+ | 51 | 46 | 71 | 5+ |
| Xenon atom | Xe | 54 | 54 | 77 | 0 |
| Magnesium ion | Mg2+ | 12 | 10 | 12 | 2+ |
| Hydride | H- | 1 | 2 | 1 | -1 |
| Sulphide ion | S2- | 16 | 18 | 16 | 2- |
| Aluminum ion | Al3+ | 13 | 10 | 14 | 3+ |
| Nitride ion | N3- | 7 | 10 | 7 | 3- |

**Naming Review -** Use subscripts to indicate the state at room temperature

|  |  |  |  |
| --- | --- | --- | --- |
|  | I, M, or A | **Name** | **Chemical Formula** |
| 1. | I | sodium chloride | **NaCl** |
| 2. | I | **Calcium carbonate** | CaCO3 |
| 4. | I | sodium hydroxide | **NaOH** |
| 5. | I | **Calcium oxide** | CaO |
| 6. | I | **Magnesium sulfate hepta hydrate** | MgSO4 |
| 7. | M | carbon dioxide | **CO2** |
| 8. | A | acetic acid | **CH3COOH** |
| 9. | M | carbon | C |
| 10. | I | calcium sulfate | CaSO4 |
| 11. | I | **Sodium silicate** | Na2SiO3 |
| 12. | I | **Calcium hydrogen carbonate** | Ca(HCO3)2 |
| 13. | I | magnesium hydroxide | **MgOH2** |
| 14. | I | potassium chloride | **KCl** |
| 15. | I | sodium thiosulfate | **Na2S2O3∙5H2O** |
| 16. | I | sodium hypochlorite | **NaClO** |
| 17. | I | **Sodium carbonate** | Na2CO3 |
| 18. | A | **Hydrochloric acid** | HCl(aq) |
| 19. | I | potassium nitrate | **KNO3** |
| 20. | I | **Copper sulfate penta hydrate** | CuSO4 |
| 21. |  | magnesium oxide | **MgO** |
| 22. | I | **Potassium iodide** | KI |
| 23. | A | **Sulfuric acid** | H2SO4(aq) |
| 24. |  | **Calcium hydroxide** | Ca(OH)2 |

**Balance the following equations.**

1. \_\_\_K(s) + \_\_\_ Cl2(g) 🡪 \_\_\_ KCl(s)
2. 2,1,2
3. 8,1,8
4. 2,2,1
5. 2,2,1
6. 2,3,1,6
7. 1,1,5
8. 4,1,2
9. 1,2,2,1
10. 3,4,4,1
11. \_\_\_Fe(s) + \_\_\_S8(s) 🡪 \_\_\_FeS(s)
12. \_\_\_H2O(l) 🡪 \_\_\_H2(g) + \_\_\_O2(g)
13. \_\_\_NaCl(s) 🡪 \_\_\_Na(s) + \_\_\_Cl2(g)
14. \_\_\_AsCl3(aq) + \_\_\_H2S(aq) 🡪 \_\_\_As2S3(s) + \_\_\_HCl(aq)
15. \_\_\_CuSO4 •5H2O(s) 🡪 \_\_\_CuSO4(s) + \_\_\_H2O(aq)
16. 2,3,3,1
17. 1,3,1,3
18. 1,2,2,1,1
19. 2,3,3,1
20. 1,2,2,1
21. 2,3,2,2
22. 1,5,3,4
23. 1,2,1,2
24. 1,3,3,1
25. \_\_\_Na(s) + \_\_\_O2(g) 🡪 \_\_\_Na2O(s)
26. \_\_\_H2S(aq) + \_\_\_KOH(aq) 🡪 \_\_\_HOH(l) + \_\_\_K2S(aq)
27. \_\_\_Fe(s) + \_\_\_H2O(g) 🡪 \_\_\_H2(g) + \_\_\_Fe3O4(s)
28. \_\_\_Al(s) + \_\_\_H2SO4(aq) 🡪 \_\_\_H2(g) + \_\_\_Al2(SO4)3(aq)
29. \_\_\_AlCl3(aq) + \_\_\_NaOH(aq) 🡪 \_\_\_Al(OH)3(s) + \_\_\_NaCl(aq)
30. \_\_\_Na2CO3(aq) + \_\_\_HCl(aq) 🡪 \_\_\_NaCl(aq) + \_\_\_H2O(l) + \_\_\_CO2(g)
31. \_\_\_Fe(s) + \_\_\_CuSO4(aq) 🡪 \_\_\_Cu(s) + \_\_\_Fe2(SO4)3(aq)
32. \_\_\_H2SO4(aq) + \_\_\_KOH(aq) 🡪 \_\_\_HOH(l) + \_\_\_K2SO4(aq)
33. \_\_\_ZnS(s) + \_\_\_O2(g) 🡪 \_\_\_ZnO(s) + \_\_\_SO2(g)

Balance the following two reactions doing C, then H then O last.

1. \_\_\_C3H8(g) + \_\_\_O2(g) 🡪 \_\_\_CO2(g) + \_\_\_H2O(g)
2. \_\_\_CH4(g) + \_\_\_O2(g) 🡪 \_\_\_CO2(g) + \_\_\_H2O(g)
3. \_\_\_H3PO4(aq) + \_\_\_NH4OH(aq) 🡪 \_\_\_HOH(l) + \_\_\_(NH4)3PO4(aq)

**Write and Balance the following Word Problems:**

1. Exothermic reaction between aqueous sodium hydroxide and sulphuric acid.

2 NaOH(aq) + H2SO4 (aq) → Na2SO4 (aq) + 2 HOH (l)

1. Formation of a precipitate by reacting sodium carbonate and calcium chloride.

Na2CO3 (aq) + CaCl2 → 2NaCl (aq)  + CaCO3 (s)

1. Adding aqueous chlorine to aqueous sodium bromide.

Cl2 (aq) + 2NaBr (aq) → 2NaCl (aq) + Br2 (l)

1. Adding a drop of lead (II) nitrate to a sliver of zinc metal

Pb(NO3)2 (aq) + Zn(s) → Zn(NO3)2 (aq) + Pb(s)

1. Adding a drop of tin nitrate to a sliver of zinc metal

Sn(NO3)4 (aq) + 2 Zn(s) → 2 Zn(NO3)2 (aq) + Sn(s)

1. There was a terrible accident in the lab! Someone took all the labels off and you need to help Ms. Williams re-label. The following is data collected from the unlabeled chemicals:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Unknown | State at SATP | Solubility | Blue Litmus Test | Red Litmus Test | Conductivity |
| A | Solid | High | Blue | Blue | High |
| B | Liquid | - | Red | Red | High |
| C | Solid | High | Blue | Red | High |
| D | Liquid | - | Blue | Red | None |
| E | Solid | Low | Blue | Red | High |
| F | Solid | High | Blue | Red | None |

Using your knowledge of ionic, molecular, acid and base properties and the data above, fill in the chart below and identify the unknown compounds. You have the following chemicals to choose from:

C6H12O6, Ba(OH)2, CaCO3, HF, LiCl, CH3OH,

|  |  |  |
| --- | --- | --- |
| Unknown | IUPAC Name | Formula  (including state in the presence of water) |
| A | Barium hydroxide | Ba(OH)2 (aq) |
| B | Hydrofluoric acid | HF(aq) |
| C | Lithium chloride | LiCl (aq) |
| D | methanol | CH3OH(l) |
| E | Calcium carbonate | CaCO3 (s) |
| F | glucose | C6H12O6 (s) or (aq) |

25. In each sample, determine what amount (in mol) of the compound is present.

(a) 8.40 g of NaOH (b) 4.2 kg of water

(c) 0.0240 kg of Na2SO4 (d) 1.77 g of CuCO3

(e) 1.00 kg of methane, CH4

26. Balance the chemical equation in each table, and use the mole numbers to complete the table. For example:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2**H2O | → | **2**H2 | + | O2 |
| 5.00 mol |  | **5.00 mol** |  | **2.50 mol** |
| **1.20 mol** |  | **1.20 mol** |  | 0.600 mol |
| **3.00 mol** |  | 3.00 mol |  | **1.50 mol** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \_\_\_\_\_Na | + | ­­­\_\_\_\_\_\_\_H2O | → | \_\_\_\_\_H2 | + | \_\_\_\_\_NaOH |
| 8.0 mol |  |  |  |  |  |  |
|  |  | 0.20 mol |  |  |  |  |
|  |  |  |  | 4.80 mol |  |  |
|  |  |  |  |  |  | 16.0 mol |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \_\_\_\_\_Al2(SO4)3 | + | ­­\_\_\_\_\_ NH4OH | → | \_\_\_\_\_Al(OH)3 | + | \_\_\_\_\_ (NH4)2SO4 |
| 3.0 |  |  |  |  |  |  |
|  |  | 2.0 |  |  |  |  |
|  |  |  |  | 1.00 mol |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Symbol | # protons | # electrons | # neutrons | Charge |
| arsenic atom | As | 33 | 33 | 42 | 0 |
| Chlorine atom | Cl | 17 | 17 | 18 | 0 |
| Antimony ion | Sb5+ | 51 | 46 | 71 | 5+ |
| Xenon atom | Xe | 54 | 54 | 77 | 0 |
| Magnesium ion | Mg2+ | 12 | 10 | 12 | 2+ |
| hydride | H- | 1 | 2 | 1 | -1 |
| Sulphide ion | S2- | 16 | 18 | 16 | 2- |
| Aluminum ion | Al3+ | 13 | 10 | 14 | 3+ |
| Nitride ion | N3- | 7 | 10 | 7 | 3- |

**Chemistry Key**

**Page 4**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I, M, or A | **Name** | **Chemical Formula** |
| 1. | I | sodium chloride | **NaCl** |
| 2. | I | **Calcium carbonate** | CaCO3 |
| 4. | I | sodium hydroxide | **NaOH** |
| 5. | I | **Calcium oxide** | CaO |
| 6. | I | **Magnesium sulfate hepta hydrate** | MgSO4•7H2O |
| 7. | M | carbon dioxide | **CO2** |
| 8. | A | acetic acid | **CH3COOH** |
| 9. | M | Carbon | C |
| 10. | I | calcium sulfate | CaSO4 |
| 11. | I | **Sodium silicate** | Na2SiO3 |
| 12. | I | **Calcium hydrogen carbonate** | Ca(HCO3)2 |
| 13. | I | magnesium hydroxide | **MgOH2** |
| 14. | I | potassium chloride | **KCl** |
| 15. | I | sodium thiosulfate pentahydrate | **Na2S2O3∙5H2O** |
| 16. | I | sodium hypochlorite | **NaClO** |
| 17. | I | **Sodium carbonate** | Na2CO3 |
| 18. | A | **Hydrochloric acid** | HCl(aq) |
| 19. | I | potassium nitrate | **KNO3** |
| 20. | I | **Copper sulfate penta hydrate** | CuSO4•5H2O |
| 21. |  | magnesium oxide | **MgO** |
| 22. | I | **Potassium iodide** | KI |
| 23. | A | **Sulfuric acid** | H2SO4(aq) |
| 24. |  | **Calcium hydroxide** | Ca(OH)2 |

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19. 2 NaOH(aq) + H2SO4 (aq) → Na2SO4 (aq) + 2 HOH (l)

20. Na2CO3 (aq) + CaCl2 → 2NaCl (aq) + CaCO3 (s)

21. Cl2 (aq) + 2NaBr (aq) → 2NaCl (aq) + Br2 (l)

22. Pb(NO3)2 (aq) + Zn(s) → Zn(NO3)2 (aq) + Pb(s)

23. Sn(NO3)4 (aq) + 2 Zn(s) → 2 Zn(NO3)2 (aq) + Sn(s)

|  |  |  |
| --- | --- | --- |
| Unknown | IUPAC Name | Formula  (including state in the presence of water) |
| A | Barium hydroxide | Ba(OH)2 (aq) |
| B | Hydrofluoric acid | HF(aq) |
| C | Lithium chloride | LiCl (aq) |
| D | Methanol | CH3OH(l) |
| E | Calcium carbonate | CaCO3 (s) |
| F | Glucose | C6H12O6 (s) or (aq) |

24.

1. a) 0.210 mol b) 2.3 x 102 mol c) 0.169 mol d) 0.0143 mol e) 62.3 mol

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 2 Na | + | ­­­2 H2O | → | 1 H2 | + | 2 NaOH |
| 8.0 mol |  | 8.0 |  | 4.0 |  | 8.0 |
| 0.20 |  | 0.20 mol |  | 0.10 |  | 0.20 |
| 9.6 |  | 9.6 |  | 4.80 mol |  | 9.6 |
| 16.0 |  | 16.0 |  | 8.0 |  | 16.0 mol |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Al2(SO4)3 | + | ­­ 6 NH4OH | → | 2 Al(OH)3 | + | 3 (NH4)2SO4 |
| 3.0 mol |  | 18.0 |  | 6.0 |  | 9.0 |
| 0.33.. |  | 2.0 mol |  | 0.66… |  | 1.0 |
| 0.5 |  | 3.00 |  | 1.00 mol |  | 1.50 |

**Physics**

* **Significant Digits** (When multiplying express your answer to the number of digits as the number with the least digits)
* **Motion**
* Uniform Motion – straight line on a graph
* Non-Uniform Motion – curved line on a graph
* **Scaler & Vector Quantities**
* Scalar quantities have magnitude only and vectors have magnitude and direction
* **Distance** – the total distance an object moves (scalar)
* **Displacement –** the straight line distance from the start point to the end point (vector)
* **Speed** Average speed = distance traveled \*scalar quantity

change in time

MMj01855860000[1]

v (m/s)

Rise

d (m)

Run

t (s)

t (s)

Slope = Rise = d = speed

Run t

* Velocity Average velocity = displacement \*vector quantity

change in time

MMj01855860000[1]

v (m/s)

Rise

d (m)

MMj01855860000[1]

Run

t (s)

t (s)

Slope = Rise = d Area = b x h

Run t = v x t

Slope = speed Area = distance

* **Acceleration**

speed

distance

time

time

Positive acceleration Negative acceleration

because the slope is increasing because the slope is decreasing

* **Force** – is a push or pull on an object

Force = Newtons = kg . m/s2

Net Force = mass x acceleration

Fnet = m x a

* **Work**
* For work to be done force and movement must both be going in the same direction.

Force

Movement

Work = Joules = Newton . m = kg . m/s2 . m

Work = force x distance

W = F x d

* Energy - is the ability to do work
* Work done on an object will change the object’s energy
* Work = Joules
* Energy = Joules
* Work = Change in Energy
* W = ΔE
* Types of Energy
* Potential Energy
* Potential energy is stored energy (due to change in position and restoring force).

Potential energy = mass x gravitational acceleration x height

Ep = m g h

* Kinetic Energy
* Kinetic energy is energy of motion

Kinetic energy = ½ mass x (velocity)2

Ek = ½ mv2

* Mechanical Energy
* Total mechanical energy of an object in motion is potential and kinetic energy combined.

Mechanical energy = Potential energy + Kinetic energy

Em = Ep + Ek

Em = m g h + ½ mv2

* Pendulum Energy Conversions
* Imagine a pendulum swinging between points A & C. Label the types of energy (Ep, Ek or both) present at points A, B & C.

**A**

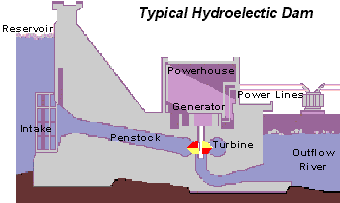
**C**

**B**

* Laws of Thermodynamics
* Energy cannot be created or destroyed, but can be transformed from one form to another or transferred from one object to another.
* Every energy transformation results in the loss of some useful energy to unusable heat energy. That is, energy flows from an organized to a disorganized state, thus increasing entropy.
* Efficiency

Efficiency = useful work output x 100%

total work input

* No process is 100% efficient. Some energy will always remain in the form of thermal energy (heat).
* Energy Conversions in Technological Systems
  1. The reservoir stores water at a higher level than the generator below the dam, so the water has gravitational potential energy due to its higher position.
  2. Water is the released into the penstock. As it flows down the penstock it loses gravitational potential energy but gains kinetic energy as it increases speed.
  3. As water reaches the turbines, its kinetic energy pushes the blades of the turbines. The kinetic energy of the water is converted to kinetic energy of the turbines.
  4. The turbines turn a coil of wire in a magnetic field, which converts the turbine’s kinetic energy into electrical energy.
  5. This electricity is then distributed from the station to our homes.

**Physics Final Review**

1. The number 10.060 contains how many significant digits?
   1. 3
   2. 4
   3. 5**☺**
   4. 6
2. The value of 1275 written correctly as two significant digits would be
   1. 12
   2. 13
   3. 1.2 x 103
   4. 1.3 x 103**☺**

1. The symbol ∆ (delta) means that you must
   1. multiply two values
   2. divide one value by another
   3. subtract to find the difference between two values**☺**
   4. add to find the sum of two values
2. Which of the following quantities is a scalar quantity?
   1. speed**☺**
   2. velocity
   3. acceleration
   4. displacement
3. Which of the following quantities is a vector quantity?
   1. time interval
   2. distance
   3. work
   4. velocity**☺**
4. Which statement correctly describes the relationship between distance and displacement between two specific points?
   1. Distance is always equal to the magnitude of the displacement.
   2. Distance is always greater than the magnitude of the displacement.
   3. Distance is never equal to the magnitude of the displacement.
   4. Distance is sometimes equal to the magnitude of the displacement**☺**.
5. Which quantity depends on the path that is taken between two points?
   1. distance**☺**
   2. displacement
   3. velocity
   4. acceleration

*Use the information below to answer the following question*

The *Galileo* spacecraft that reached Jupiter in 1995 sent back a wealth of information about the giant planet. Galileo launched a probe into the atmosphere of Jupiter. Before it was eventually crushed by the immense pressure of Jupiter’s lower atmospheric layers, the probe relayed information back to Earth. *Galileo* used the gravitational forces between Venus and Earth to accelerate to a speed of 39 km/s

Numerical Response 1

The distance Galileo travelled in one minute at a speed of 39 m/s, expressed in scientific notation, is ***b*** x 10 *w* m.The value of ***b*** is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_m.**2.34x103**

*(Round and record your answer to three digits)*

*Use the following graph to answer the next two questions*

1. From t=1 s until t=2 s, the car is
   1. stopped
   2. accelerating uniformly
   3. negatively accelerating uniformly
   4. travelling at uniform speed**☺**
2. The distance that the car travelled from t =0 s to 1 s and from t = 1 s to 2s are, respectively,
   1. 5.0 m and 0 m
   2. 5.0 m and 10.0 m**☺**
   3. 10.0 m and 5.0 m
   4. 10.0 m and 10.0 m

Wayne Gretzky is arguably the greatest hockey player of all time. He holds many individual including the NHL career record for points scored.

Numerical Response 2

If Gretzky shoots the puck at a speed of 90 km/h from the top of the offensive face-off circle 15 m from the net, how long will the puck take to reach the net? \_\_\_\_\_\_\_\_\_ s **0.60**

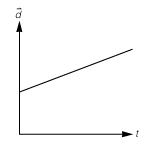
*(Round and record your answer to two significant digits)*

*Use the following information to answer the next two questions*

Some of the fastest moving arachnids are the long-legged Sun spiders (genus *Solpuga)* found in semi-desert areas throughout the world. These spiders are capable of moving up to 16 km/h.

1. Moving at maximum speed, what is the shortest time it would take a Sun Spider to run between two fig trees that are 3.6 m apart?
   1. 0.23 s
   2. 14 s
   3. 1.5 s
   4. 0.81 s**☺**

*Use the following information to answer the next question.*



1. Which velocity-time graph describes the same motion as the displacement-time graph shown above?

|  |  |
| --- | --- |
| **A.** | **B. ☺** |
|  |  |
| **C.** | **D.** |
|  | v |
|  |  |

1. Which statement about a graph of position versus time is **not** true?
   1. A horizontal line indicates that the object was standing still.
   2. A downward slope of a straight line indicates that the object was slowing down**☺**.
   3. An upward slope of a straight line indicates that the object was moving at a constant velocity.
   4. An upward curving line (a changing slope) indicates that the object was accelerating.
2. What force is needed to lift a 4.54 kg bag of sugar at constant speed?
   1. 4.54 N
   2. 44.5 N**☺**
   3. 0.463 N
   4. The force cannot be calculated unless you know the distance the sugar is lifted.
3. The weight of an object is
   1. the same as its mass
   2. the force of gravity acting on its mass**☺**
   3. not related to its mass
   4. any force acting on its mass

Numerical Response 3

Imagine that you carry a box of books, weighing 67.8 N, up a flight of stairs. If each step is 15.0 cm high, and there are 22.0 steps in the flight of stairs, how much work do you do on the box of books? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ J**224**

*(Round and record your answer to three significant digits)*

1. According to the formula for kinetic energy, what combination of units is the same as a joule? [Hint: consider what you use to calculate potential energy]

|  |  |
| --- | --- |
| **A http://highered.mcgraw-hill.com/sites/dl/free/0070890862/141729/SF10_Ch05_Q7d.jpg** | **C.** |
| **B☺.** | **D.** |

1. When you **throw** a ball into the air and it reaches its maximum height
   1. the ball would contain only kinetic energy
   2. the ball would contain half potential and half kinetic energy
   3. the ball would be moving at it maximum velocity
   4. the ball would contain all potential energy**☺**
2. A soccer goalie catches and holds the fast-moving ball. What happens to the kinetic energy of the ball?
   1. Kinetic energy stays the same because energy is conserved.
   2. Kinetic energy is destroyed because the ball stops moving.
   3. Kinetic energy is transformed into potential energy. **☺**
   4. Kinetic energy is transformed into heat.
3. How can you increase the kinetic energy of a person moving on a playground swing?
   1. Push in the same direction as the swing is moving. **☺**
   2. Push in the direction opposite to the motion of the swing.
   3. Push sideways to change the direction the swing is moving.
   4. Kinetic energy cannot be increased because energy is conserved.

*Use the following information to answer the next three questions*

Pierre Lueders from Edmonton, Alberta, is a world and Olympic champion in the two-man bobsled event. Lueders trains at one of the world’s most challenging runs located in Calgary Alberta. The bobsled run at the Calgary Olympic Park has a length of 1500 m and a height of 121 m.

1. A bobsled including its riders, has a mass of 250 kg, how much potential energy doe the bobsled have as it is about to start its run?
   1. 297 MJ**☺**
   2. 297 kJ
   3. 29.7 MJ
   4. 297 J
2. If all the potential energy from the bobsled is converted into kinetic energy as the bobsled speeds past the finish line, what is the bobsled’s velocity?
   1. 2374.0 m/s
   2. 97.4 m/s
   3. 48.7 m/s**☺**
   4. 1187.0 m/s
3. Although this potential energy is converted into kinetic energy, some potential energy is
   1. Evaporated into the atmosphere
   2. Converted to mass
   3. Conserved as potential energy
   4. Lost through friction**☺**
4. A race car races a 100 m sprint track at an average speed of 9.50 m/s. If the car's kinetic energy is 9.40 x 103J what is its mass?
   1. 1.98 x 103 m/s
   2. 208 kg**☺**
   3. 104 kg
   4. 52.1 kg
5. Which statement about the relationship between work and kinetic energy is **not** true?
   1. When a force does work on an object, the object might gain kinetic energy.
   2. When a force does work on an object, the object might lose kinetic energy.
   3. When a force does work on an object, the object always gains kinetic energy. **☺**
   4. When a force does work on an object, the object might have no change in its kinetic energy.
6. Which statement about the motion of a pendulum is *not* true?
   1. All the energy is gravitational potential energy at the top of the swing.
   2. All the energy is gravitational potential energy at the bottom of the swing. **☺**
   3. All the energy is kinetic energy at the bottom of the swing.
   4. The energy is partly gravitational potential energy and partly kinetic energy between the top and bottom of the swing.
7. The useful output energy of a motor is
   1. sound
   2. heat
   3. light
   4. kinetic energy**☺**

*Use the following information to answer the next 2 questions.*

|  |
| --- |
| Electric motors are between 50% and 90% efficient at converting electrical energy to useful energy, which causes the motion of the motor shaft. Suppose that a particular motor is measured to be 73% efficient. |

1. The motor described above is 73% efficient. What does this mean?
   1. 73% of the input energy is wasted.
   2. 73% of the input energy is converted to heat.
   3. 73% of the input energy is converted to kinetic energy. **☺**
   4. 73% of the input energy is **not** converted to some other form.
2. For every 100 J of input energy supplied to the motor, how much energy is wasted?
   1. 27 J**☺**
   2. 46 J
   3. 73 J
   4. 100 J

*Use the following information to answer the next question*.

The process of photosynthesis allows green plants to produce glucose, C6H12O6. Glucose is used as a food source. The chemical equation for photosynthesis is:

6CO2(g) + 6H2O(l) → C6H12O6(aq) + 6O2(g)

1. The process of photosynthesis results in an increase in
   1. kinetic energy
   2. potential energy**☺**
   3. light energy
   4. thermal energy

Numerical Response 4

Approximately 4.2 X 104 kJ of energy from sunlight strikes the leaves of a plant in one day. Of this energy 4 200 kJ is converted into useful energy by the plant. The efficiency of photosynthesis in this plant is \_\_\_\_\_ % **10**

*(Round and record your answer correct to two significant digits)*

**Part II Matching:**

|  |  |
| --- | --- |
| Match each of the following descriptions to the correct quantity. You may use each answer once, more than once, or not at all. | |
| 1. \_\_\_\_ any form of stored energy **M** 2. \_\_\_\_ change in velocity during a unit time interval **A** 3. \_\_\_\_ describes size and direction **P** 4. \_\_\_\_ describes size but not direction **N** 5. \_\_\_\_ difference between two times **I** 6. \_\_\_\_ displacement in a unit time (for example, one second or one hour) **Q** 7. \_\_\_\_ distance traveled in a unit time (for example, one second or one hour) **O** 8. \_\_\_\_ energy stored in a material that is bent, compressed, or stretched and will return to its original shape when released. **F** 9. \_\_\_\_ energy stored in the bonds which hold atoms, ions, and molecules together **B** 10. \_\_\_\_ energy stored in the inner core of an atom **K** 11. \_\_\_\_ length of a path from one point to another **E** 12. \_\_\_\_ location relative to a particular reference point **L** 13. \_\_\_\_ size or amount **J** 14. \_\_\_\_ stored energy associated with the force of gravity between two objects **H** 15. \_\_\_\_ straight line distance and direction from one point to another **D** | * 1. Acceleration   2. Chemical potential energy   3. Conservation   4. Displacement   5. Distance   6. Elastic potential energy   7. Force   8. Gravitational potential energy   9. Interval   10. Magnitude   11. Nuclear potential energy   12. Position   13. Potential energy   14. Scalar   15. Speed   16. Vector   17. Velocity   18. Work |

**Part III Long Answer:**

1. A jackrabbit can reach a velocity of +18.5 m/s from a resting position in 1.25 s. What is the rabbit’s acceleration? **14.8 m/s**
2. While riding up a chair lift, a 54.8 kg skier gains 4.22 × 105 J of gravitational potential energy. The top of the ski lift is what vertical distance above its base? **785m**
3. In a toy, a 92.4 g ball rolls into a spring and compresses the spring. If the ball is rolling at 4.28 m/s when it collides with the spring and, at maximum compression, the spring is storing 0.560 J of elastic potential energy, with what efficiency is the ball’s kinetic energy converted into elastic potential energy of the spring? **66.2%**

Fill in the following chart, the first example is done for you:

|  |  |  |
| --- | --- | --- |
|  | Graph Sketch | Calculations obtained from graph |
| Distance vs. Time (uniform motion) |  | Slope of graph = velocity |
| Distance vs. Time  (at rest) |  | **Slope of graph = velocity**  **Slope = 0** |
| Velocity vs. Time  (uniform velocity) |  | **Area under graph = distance**  **A=bh** |
| Velocity vs. Time  (positive acceleration) |  | **Area under graph = distance**  **A=1/2bh** |

Answer Key:

1. C
2. D
3. C
4. A
5. D
6. D
7. A
8. D
9. B
10. D
11. B
12. B
13. B
14. B
15. B
16. D
17. C
18. A
19. A
20. C
21. D

|  |  |  |
| --- | --- | --- |
|  | Graph Sketch | Calculations obtained from graph |
| Distance vs. Time (uniform motion) |  | Slope of graph = velocity |
| Distance vs. Time  (at rest) | t    d | **Slope of graph = velocity**  **Slope = 0** |
| Velocity vs. Time  (uniform velocity) | t    v | **Area under graph = distance**  **A=bh** |
| Velocity vs. Time  (positive acceleration) | t    v | **Area under graph = distance**  **A=1/2bh** |

1. B
2. C
3. B
4. D
5. C
6. A
7. B

NR1: 2.34

NR2: 0.60

NR3: 224

NR4: 10

PARTII:

1. M
2. A
3. P
4. N
5. I
6. Q
7. O
8. F
9. B
10. K
11. E
12. L
13. J
14. H
15. D

PART III:

1. 14.8 m/s2
2. 785 m
3. 66.2%

**BIOLOGY**

* The smallest functional unit of life & all living things are composed of cells
* All Cells:
* Need energy
* Produce wastes
* Respond and adapt to their environment
* Reproduce
* Grow
* Development of Cell Theory

–1590 – compound microscope invented

–1665 – Robert Hooke noticed structures while viewing slices of cork – cells

–1700 – Anton van Leeuwenhoek observes living cells with a microscope

–1700 + - more structures identified as technology gets better

–1838 – Schwann and Schleiden proposed that plant and animal tissue are made of cells

# The Cell Theory

## All organisms are composed of one or more cells.

## lightpltThe cell is the smallest function unit of life.

## All cells are produced from other cells.

## Plant vs. Animals

**PLANT Cells**

## 1) Only plant cells contain chloroplasts

## Chk_cell2) LARGE central vacuole & contain a cell wall

## **ANIMAL Cells**

## Only animal cells contain lysosomes

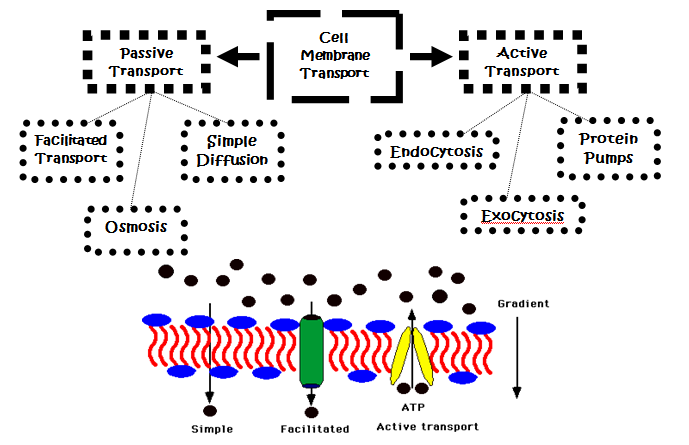
## Animal cells have centrioles

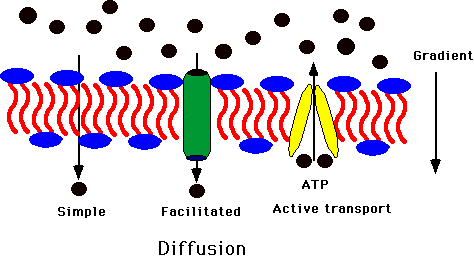
## Organelles Structure & Function - You must know all the organelles and their function.

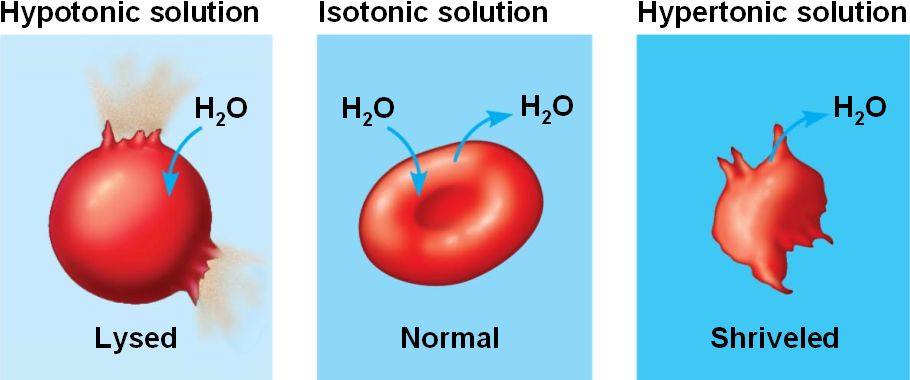
**The Microscope**

|  |  |  |  |
| --- | --- | --- | --- |
|  | TRANSMISSION LIGHT MICROSCOPE | TRANSMISSION ELECTRON MICROSCOPE (TEM) | SCANNING ELECTRON MICROSCOPE (SEM) |
| GREATEST MAGNIFICATION | 1 000 | 100 000 (to 1 million) | 20 000 |
| IMAGE PRODUCED BY | light passing through the material | electrons passing through the material | electrons reflected from the material |
| FOCUSING DONE BY | ground glass lenses | electromagnets | electromagnets |
| IMAGE PRODUCED ON | retina in the eye/monitor | monitor | monitor |
| QUALITY OF IMAGE PRODUCED | colour, two-dimensional, internal structure, low resolving power | black & white, two-dimensional, internal structure, high resolving power | black & white, three-dimensional, surface detail, high resolving power |
| ADVANTAGES | colour image, living material can be viewed | very great magnification, details of internal structure | great magnification, images can be easily understood |
| DISADVANTAGES | low magnification, 2-dimensional image | material must be dead (dried), image difficult to interpret | material must be dried (dead) |

* **Cell Membrane Transport**



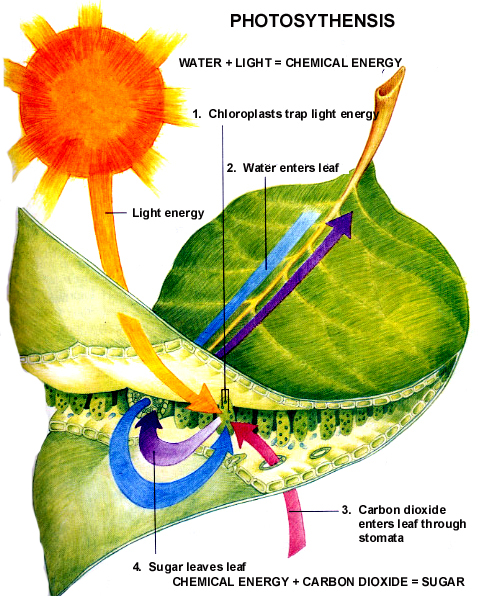




* **Is bigger better?**

Cells can’t get too big for if they do they will not be able to get material into the cell fast enough.

* **Photosynthesis**

 **Glucose + Oxygen**

**6H2O(l) + 6CO2(g)**

**C6H12O6(aq) + 6O2(g)**



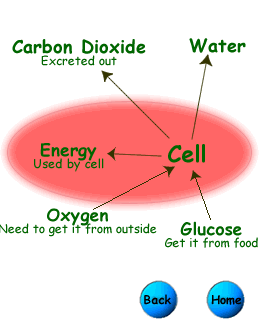
* **Cellular Respiration**

**Glucose + Oxygen**

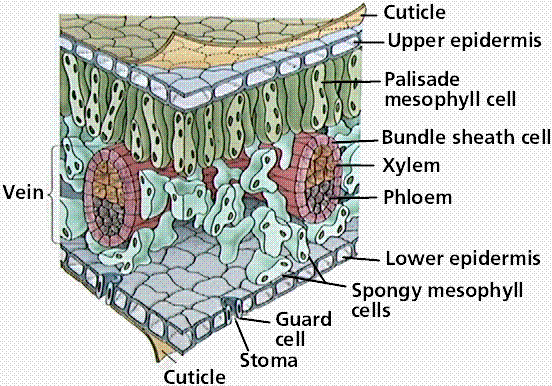
**Water + Carbon Dioxide**

**C6H12O6(aq) + 6O2(g) 6H2O(l) + 6CO2(g)**

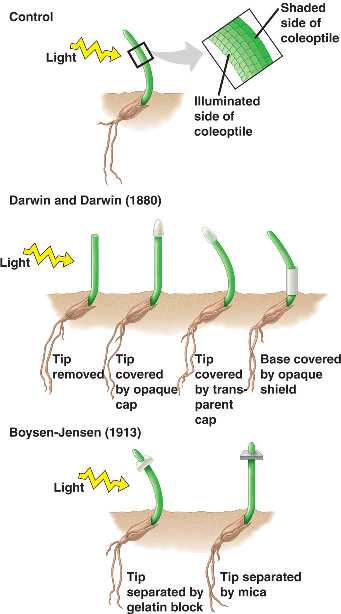
* **Gas Exchange**

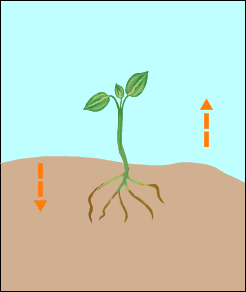


* **Structures in a leaf**





* **Root to Leaf Water Transport**
* Xylem and phloem vessels
* **Phototropism**
* Response to light
* Bends toward the light because of the release of auxin from the tip of the plant
* Auxim results in the side in the shade growing faster and therefore bending.
* **Darwin’s experiment on phototropism**
* **Gravitropism**
* Positive gravitropism- is growing upwards away from gravity.
* Negative gravitropism – is growing downwards towards gravity.
* **Nastic Response**
* A plant responds to touch

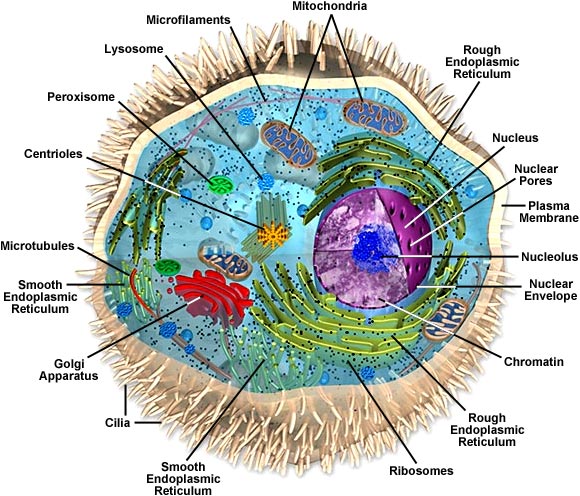


**Practice:** Convert the following

1. Fill in the values for the missing magnifications.

|  |  |  |
| --- | --- | --- |
| Ocular | Objective | Total |
| 1x | 4.5x | 4.5x |
| 10x | 4x | 40x |
| 3x | 5x | 15x |
| 10x | 225x | 2250x |
| 40x | 600x |  |
| 2x | 5x | 10x |
| 10x | 100x | 1000x |
| 5x | 10x | 50x |
| 2x | 20x | 40x |

1. At 40x the field of view is measured to be 0.55 mm. What would the FOV be at 300x? Give your answer in μm. (73μm)
2. Name the of the cell structure that fits the statement.
3. produces ATP \_\_\_\_\_\_Mito\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. produces proteins \_\_\_\_\_\_ribosomes\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. stores food, water, or wastes \_\_\_\_vacuole\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. contains DNA \_\_\_\_nucleus\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. converts solar energy to chemical energy \_\_\_\_chloroplast\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. is used to digest material inside the cell \_\_\_\_Lysosome\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. protects the cell membrane \_\_\_\_cell wall\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. packages substances for secretion \_\_\_\_golgi Body\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. intracellular transport. \_ER\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. "gatekeeper" of the cell \_ membrane\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. the "powerhouse" of the cell \_\_ Mitochondria \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. Label the following Diagram



1. Estimate the length of the following organisms given that the FOV is = 500 μm.

a

c

b

a =

b =

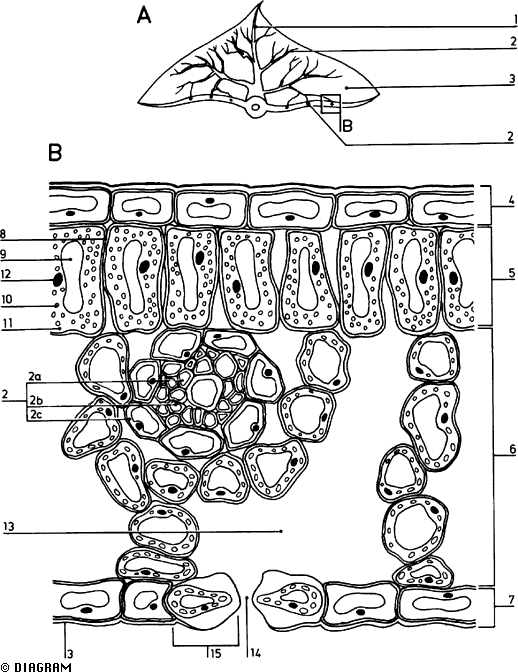
c =

1. Define the following terms:
2. isotonic -
3. hypertonic -
4. hypotonic -
5. osmosis -
6. diffusion -
7. semi-permeable -
8. concentration gradient -
9. equilibrium –
10. Write the balanced chemical equation for the reaction that occurs in the chloroplast of a plant cell.
11. Write the balanced chemical equation for the reaction that occurs in the mitochondria of a cell.
12. What would happen to an animal cell that is placed in a :
13. hypotonic solution?
14. hypertonic solution
15. isotonic solution
16. Discuss what would occur if plants had no hormones called auxins. Include the effects from gravity, the sun and from water.
17. What are the specialized cells that move water from the roots to the leaves of a plant?
    1. phloem tissue cells
    2. xylem tissue cells \*
    3. water pump cells
    4. water tubules
18. The transport of water up the plant is aided by root pressure. How is this pressure created?
    1. The weight of the surrounding dirt on the roots of the plant.
    2. Root pressure is created when water flows into the root system, trying to dilute the solutes inside. \*
    3. Tiny pump cells within the roots create this pressure.
    4. The cambium of the root creates this pressure.
19. Many plants have adaptations to help them survive in certain climates. The cactus is one such plant. Its leaves have been modified into spines in an effort to:
    1. increase the amount of surface area for photosynthesis.
    2. reduce the amount of shade produced by the plant.
    3. reduce the amount of water lost by transpiration. \*
    4. increase the surface area for dew to collect.
20. One major difference between xylem cells and phloem cells is:
    1. Xylem cells are very square in shape while phloem cells are not.
    2. Phloem cells are covered in tiny hair-like projections to increase absorption while xylem cells are not.
    3. Phloem cells are dead while xylem cells are alive.
    4. Xylem cells are dead while phloem cells are alive. \*
21. Water has two special properties that make it possible for plants to transport water up great distances within their vascular tissues. One property is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is a tendency of water molecules to stick to each other, and the other is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is a tendency for water molecules to stick to other surfaces.
    1. cohesion, adhesion\*
    2. cohesion, attraction
    3. adhesion, cohesion
    4. adhesion, attraction
22. A number of processes and forces are necessary for moving water and nutrients from the soil around the plant to the leaves. In order, these processes are:
    1. adhesion/cohesion, osmosis/diffusion, transpiration
    2. adhesion/cohesion, transpiration, osmosis/diffusion
    3. osmosis/diffusion, adhesion/cohesion, transpiration\*
    4. osmosis/diffusion, transpiration, adhesion/cohesion
23. Why do trees that have their outer bark and xylem damaged quite often die?
    1. They are no longer able to move food from the leaves to the roots of the plant, and once the roots die, the plant dies. \*
    2. They are no longer able to move water from the roots to the leaves, and once the leaves die, the plant dies.
    3. The damaged area allows disease to get into the tree and kill it.
    4. The tree dries out as a result of the damaged area.
24. Plants are able to respond to stimuli from around them. What are these responses called?
    1. reactions
    2. tropisms\*
    3. controls
    4. auxins
25. In 1880, Charles Darwin and his son devised an experiment in which they used oat seedlings. They set up four treatment groups of developing seedlings. In the first group, they removed the tip, in the second, they covered the tip with foil, in the third, they covered the base of each seedling with foil, and they left the fourth group untouched. What were they trying to test?
    1. phototropism\*
    2. gravitropism
    3. oilotropism
    4. nastic response
26. There are many reasons that a plant might need to be able to sense where "up" is. Which of the following is NOT one of the potential reasons?
    1. to make the developing seed grow in the correct direction
    2. to make the plant out compete neighbouring plants for sunlight
    3. to ensure that the plant transports water in the correct direction\*
    4. to make the roots grow in the correct direction
27. In the early 1900s, a Dutch researcher named Frits Went confirmed that there was a chemical produced in the stem tips of growing seedlings that stimulated growth. He named this chemical:

* 1. SGH (seedling growth hormone)
  2. GH (growth hormone)
  3. agar
  4. auxin\*

Color the following structures. Then create a legend matching the color to the structures name.

* Xylem
* Chloroplast
* Nucleus
* Vacuole
* Cytoplasm
* Phloem
* Cuticle
* Epidermis
* Palisade Tissue
* Spongy Tissue
* Stoma
* Guard cell
* Cell wall



**Answers:**

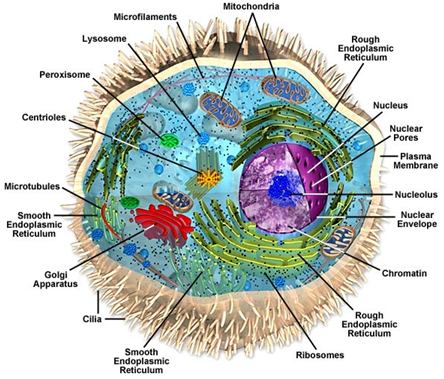
**1.**

|  |  |  |
| --- | --- | --- |
| Ocular | Objective | Total |
| 1x | 4.5x | 4.5x |
| 10x | 4x | 40x |
| 3x | 5x | 15x |
| 10x | 225x | 2250x |
| 40x | 600x |  |
| 2x | 5x | 10x |
| 10x | 100x | 1000x |
| 5x | 10x | 50x |
| 2x | 20x | 40x |

**2. 75 um**

**3. a) mitochondria b) ribosomes c) vacuole d) nucleous e) chloroplast f) lysosome**

**g) cellwall h) golgi body i) er j) membrane k) mitochondria**



4. a) 250 um b) 100 um c) 300 um

6. photosynthesis: 6CO2 + 6H2O → C6H12O6 + 6O2

7. respiration: C6H12O6 + 6O2 →6CO2 + 6H2O

8. a) cell will swell b) cell will shrink c) cell will do nothing

9. The plant will not bend toward light

10. B 11. B 12. C 13. D 14. A 15. C 16. A 17. B 18. A 19. C 20. D

21.

* Xylem – 2 (in vascular bundle)
* Chloroplast - 10
* Nucleus - 12
* Vacuole - 9
* Cytoplasm - 11
* Phloem – 2 (in vascular bundle)
* Cuticle - 3
* Epidermis – 4 and 7
* Palisade Tissue - 5
* Spongy Tissue - 6
* Stoma - 14
* Guard cell - 15
* Cell wall - 8

**Unit D: Energy Flow in Global Systems**

**Defining Systems**

* **system** – the specific object or group of objects under observation
* **surroundings** – everything over than the system; implies that the system has a boundary
* classes of systems:
  + **open system –** allows energy and matter to cross the system’s boundary
  + **closed system –** allows energy but not matter to cross the boundary
  + **isolated system** – allows neither energy or matter to move across the boundary

**The Biosphere**

* **biosphere –** the thin layer of air, land and water on or near Earth’s surface that contains all life on Earth
  + hydrosphere (water)
    - cryosphere – water that is temporarily frozen in polar ice caps, snow, permafrost and glaciers
  + lithosphere (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
  + atmosphere (\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

**Earth’s Radiation Budget**

* + - **radiation –** the mechanism of energy transfer in which atoms or molecules emit electromagnetic waves
    - types of radiation

► radio waves ► microwaves **►** infrared radiation

► visible light **►**ultraviolet radiation **►** X-rays

► gamma rays

* + - * + the different types of radiation are affected differently as they enter Earth’s atmosphere – visible light passes through virtually unchanged
        + **radiation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ –** the energy and temperature balance maintained on Earth by radiating the same quantity of energy into space as is absorbed from the Sun
        + **albedo –** the ability of a surface to reflect energy
        + **greenhouse effect –** the retention of heat on and above Earth’s surface by greenhouse gases (water vapour, carbon dioxide, methane, ozone and CFC’s)
  + natural phenomenon that maintains Earth’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Climate and Seasons**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**– trend in temperature, atmospheric pressure, humidity and precipitation over a period of many years
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – the conditions in a particular place at a particular time

**Thermal Energy Transfer**

* **specific heat capacity –** the amount of heat required to raise the temperature of 1 g of a substance by 1oC
* **Q=mc∆T** Q = amount of heat in joules (J)

m = mass in grams (g)

c = specific heat capacity (J/g oC)

∆T = change in temperature (oC)

* methods of transferring thermal energy:
  + conduction convection radiation

**Phase Changes**

* **phase change –** a physical change from one state to another
* **heat of fusion (Hfus)-** the quantity of energy required to melt one mole of a substance

**Q=nHfus** Q = amount of heat or energy in joules (J)

n = number of moles

Hfus = heat of fusion (J/mol)

* **heat of vaporization (Hvap) –** the quantity of energy required to convert one mole of a substance from a liquid to a gas

**Q=nHvap** Q = amount of heat or energy in joules (J)

n = number of moles

Hvap = heat of vaporization (J/mol)

* **the amount of energy that is released when a mole of substance freezes is the same as the amount required to melt it.**

**Unique Properties of Water**

* water has a high specific heat capacity
  + large amounts of \_\_\_\_\_\_\_\_\_\_\_ are required to change the temperature
  + large bodies of water such as oceans and large lakes have a \_\_\_\_\_\_\_\_\_\_ effect on the air temperature of nearby land communities
* water has a high heat of vaporization
  + evaporative \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* water has a high heat of fusion
  + ice has a lower density than liquid water; ice floats

**The Hydrologic Cycle**

* **hydrologic cycle –** the circulation of water among the oceans, land and the atmosphere; also called the water cycle

**Distributing the Heat**

* tropical regions absorb more heat than is radiated to space (heat \_\_\_\_\_\_\_\_\_\_)
* latitudes greater than 40o north and south have a heat deficit; more heat is radiated than is absorbed
* ocean currents and air currents redistribute the heat across Earth’s surface
* ocean currents
  + global ocean current called the thermohaline circulation or the “Great Ocean Conveyor Belt” redistributes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Gulf Stream – a large surface current in the ocean that follows the eastern coastline of the United States and Canada and then moves across the Atlantic towards the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + North Atlantic Drift – the name of the Gulf Stream at the point where it reaches the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + El Nino – a disruption of the ocean-atmosphere system in the tropical Pacific that typically occurs every 3 – 7 years
    - wind direction over the South Pacific reverses and the wind flows eastward
    - causes pronounced \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ during the winter months in western North America ☺
  + La Nina – a disruption of the ocean-atmosphere system that is opposite to that of El Nino, characterized by an increase in the strength of westward moving winds
    - produces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than normal conditions in western Canada and the US
* air currents
  + an area of low pressure occurs as warm air \_\_\_\_\_\_\_\_\_\_\_\_\_\_, becomes \_\_\_\_\_\_\_\_\_\_\_\_\_ dense and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + an area of high pressure occurs as cold air \_\_\_\_\_\_\_\_\_\_\_\_, becomes more \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + as air begins to move north or south from the equator it cools and sinks before it reaches the poles
    - air descends at three separate latitudes in each hemisphere
      * 30o (N & S), 60o (N & S) and the Poles
      * known as the “three-cell model”
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ effect – the tendency of convection currents or other moving objects on the surface of Earth to veer sideways from their original course due to Earth’s rotation on its axis
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ streams – currents of extremely fast-moving air located about 10-15 km above Earth’s surface
    - form at the boundaries of cold and warm air
    - generally move from west to east
    - larger in the winter due to greater differences in air temperature

How Oceans and Mountains Influence Climate

* sea breeze – a current of moving air blowing from an ocean or a large lake towards land
* land breeze – a current of moving air blowing from land out onto an ocean or large lake
* orographic precipitation – precipitation that develops when warm, moist air cools and condenses as it rises against mountains
* rain shadow – a region that receives little rain because it is situated on the side of a mountain farthest from the prevailing winds

Describing Climate

* climatograph – a graphical representation of climate data for a specific region and time period

Organization of the Biosphere

* biome – a major geographic region with a particular combination of environmental conditions and life forms
  + aquatic biomes
  + terrestrial biomes
    - tundra
    - taiga
    - desert
    - grassland
    - deciduous forest
    - tropical rainforest
* ecosystem – the community of living organisms (biotic factors) that interact with each other and with the non-living environment (abiotic factors)
* habitat – the place where an organism lives

Adaptations & Biomes

* all organisms are adapted to survive in certain climates but not in others
* adaptation – any characteristic that enables an organism to better survive and reproduce in an environment
  + physiological – occur primarily inside an organism
  + structural – physical features of an organism
  + behavioural – something an organism does

Natural Change in Biomes

* **paleoclimatology –** study of past \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + look at ice cores, fossils and tree rings to give clues about past climates
* possible causes of climate change:
  + Earth’s tilt – the tilt of the earth has in the past fluctuated between 22.3o and 24.5o. When the tilt is at a maximum the poles receive more solar radiation and are warmer than average.
  + Earth’s orbit – the shape of the Earth’s orbit fluctuates over periods of about 100,000 years; influences the amount of solar radiation reaching the earth.
  + continental drift – theory that proposes that about 225 million years ago the tectonic plates of the Earth formed a giant supercontinent (Pangea). As the tectonic plates have moved the different continents have been formed. This movement affected how the oceans could transfer heat around the Earth.
  + weathering – rocks are broken down into smaller pieces – can occur through physical and chemical processes. Chemical weathering uses up atmospheric carbon dioxide.
  + catastrophic events – meteors, asteroids, and volcanic eruptions release a lot of dust, ash and smoke into the atmosphere. A thick cloud of smog may have prevented sunlight from reaching the earth’s surface.
  + feedback – responses to climate change can result in additional changes to climate – this is known as feedback.

**Positive Feedback Loop**

-a change will cause an increased change in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ direction

**Negative Feedback Loop**

-A change will cause a change in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ direction of the original change

* **mass extinction events** – living organisms respond to changes in their environment; if the change is too sudden or too drastic organisms may not be able to adapt and they may die.

Predicting Climate Change

**General Circulation Models (GCMs)**

* complex mathematical models that predict future climate using the laws of conservation of momentum, mass, moisture and energy
* 2 major uncertainties when predicting climate:
  + predicting the amount of greenhouse gases in the future
  + predicting how climates will respond to an increase in greenhouse gas concentration

**Human Response to Climate Change**

* **precautionary principle –** the principle that, in order to protect the environment, lack of scientific certainty will not be used as a reason to postpone measures to prevent environmental damage
* **Gaia Hypothesis –** the Earth is a single, living organism
  + Dr. James Lovelock

Unit Test

Section I: Multiple Choice (25 marks)

1. Which of the following statements are examples of climate?

I. Not another day of rain!

II. Once again, it’s a cold winter.

III. We had 3 mm of rain last night.

IV. Spring always seems to come about this time of year.

a) I and II

b) II and III

c) II and IV

d) III and IV

2. The non-living components of the biosphere are:

a) lithosphere, hydrosphere, atmosphere

b) hydrosphere, cryosphere and atmosphere

c) lithosphere, crust, hydrosphere, atmosphere

d) lithosphere, hydrosphere, troposphere, climate

3. Weather occurs in which layer of the atmosphere?

a) troposphere

b) mesosphere

c) stratosphere

d) thermosphere

4. Which of the following statements is an example of scientific evidence of climate change?

I. The growing season seems longer now.

II. There are fewer elk now than there were 20 years ago.

III. Snow cover has increased by 4% over the past 10 years.

IV. The average global surface temperature has increased by 0.5°C in the last century

a) I and II

b) I and IV

c) II and III

d) III and IV

5. In order with increasing altitude, Earth’s atmospheric layers are:

a) troposphere, mesosphere, thermosphere, stratosphere

b) troposphere, stratosphere, mesosphere, thermosphere

c) thermosphere, mesosphere, troposphere, stratosphere

d) mesosphere, troposphere, stratosphere, thermosphere

6. Which of the following is NOT part of the electromagnetic spectrum?

a) x-rays

b) visible light

c) cathode rays

d) ultraviolet light

7. A town along the equator gets more insolation, on average, than Calgary, Alberta, because of the effect of:

a) less atmospheric dust

b) the angle of incidence

c) the angle of inclination

d) both the angle of incidence and angle of inclination

8. Suppose that all the trees in a region are cut down, exposing dark soil. Assuming that no vegetation grows back, how will the albedo of this region change?

a) There will be no change in the albedo.

b) Albedo will increase in summer and in winter.

c) Albedo will decrease in summer and in winter.

d) Albedo will decrease in summer and increase in winter.

9. Which statement describes the relationship between average net radiation budget and latitude?

a) The net radiation budget does not change with latitude.

b) There is a net radiation budget surplus at the equator and at the poles.

c) The net radiation budget is the same at both the equator and the poles.

d) There is a net radiation budget surplus at the equator, and a net radiation budget deficit at the poles.

10. Thermal energy can be transferred globally by:

a) winds

b) water currents

c) convection only

d) winds and water currents

11. Water currents and wind currents flow clockwise in the Northern hemisphere due to:

a) the Coriolis effect

b) convection currents

c) thermal energy imbalances

d) changes in atmospheric pressure

12. The hydrological cycle transfers:

a) water

b) energy

c) greenhouse gases

d) water and energy

13. The amount of energy released when 1 mol of water vapour changes phase to liquid water, without a change in temperature, is called:

a) the heat of fusion

b) the heat of vaporization

c) the heat of condensation

d) the specific heat capacity

14. Which of the following factors would not influence the net radiation budget of a biome?

a) albedo

b) longitude

c) time of year

d) cloud cover and atmospheric dust

15. On average, which biome has the highest precipitation level and average temperature?

a) taiga

b) grassland

c) rain forest

d) deciduous forest

16. Which of the following biomes is most important to the agricultural industry?

a) taiga

b) tundra

c) grassland

d) deciduous forest

17. Two cities are located at the same latitude but in different regions of Earth. Which of the following factors could cause these cities to have different climates?

a) the angle of inclination of Earth

b) the number of hours of daylight

c) the biome in which each city is located

d) whether either city is situated close to a large body of water

18. Which of the following greenhouse gases has the highest Global Warming Potential (GWP)?

a) CFCs

b) methane

c) nitrous oxide

d) carbon dioxide

19. Which of the following removes carbon dioxide from the atmosphere?

a) Earth’s oceans

b) the ozone layer

c) using public transit

d) conserving electricity

20. A scientist reports that her conclusions on the historic greenhouse gas concentrations, deduced from data taken from ice core samples, are very likely to be correct. These conclusions should be considered to have:

a) a low level confidence

b) a medium level confidence

c) a very high level of confidence

d) an extremely low level of confidence

21. The United Nations Framework Convention on Climate Change was important because it provided:

a) an outline for future agreements

b) an opportunity to recognize the issue of climate change

c) a process to charge countries producing too much greenhouse gas

d) an opportunity to identify countries producing the most greenhouse gases

22. One of the major limits to making better computer-based climate models is:

a) faster computers

b) understanding global climate processes

c) collecting more data from existing research projects

d) more support for research on the use of technology to study climate

23. If the amount of carbon dioxide were to double, which of the following biomes is predicted to increase in area in Alberta?

a) desert

b) tundra

c) grasslands

d) deciduous forest

24. Which of the following sectors is NOT included in *Canada’s Action Plan on Climate Change*?

a) tourism

b) industry

c) agriculture

d) transportation

Section II: Numerical Response (16 marks)

25. How much thermal energy is required to increase the temperature of 500 g of water from 20.0°C to 80.0°C? The specific heat capacity of water is 4.19 J/g·ºC. (3 marks)

26. When 200 g of an unknown substance absorbs 4.30 kJ of thermal energy, the temperature of the substance changes from 30.0°C to 80.0°C. Determine the experimental specific heat capacity of the unknown substance. (3 marks)

27. How much thermal energy is absorbed when 1.00 kg of ice melts completely, without a change in temperature? The theoretical heat of fusion of ice is 6.01 kJ/mol and the molar mass of ice is 18.02 g/mol. (3 marks)

28. a) How much thermal energy is needed to heat 100 g of water at 25.0ºC to 100.0ºC, without a change in phase? The theoretical specific heat capacity of water is 4.19 J/g·ºC. (3 marks)

b) How much thermal energy is absorbed when 100 g of water at 100.0ºC evaporates completely, without a change in temperature? The heat of vaporization of water is 40.7 kJ/mol and the molar mass of water is 18.02 g/mol. (3 marks)

c) Using your answers from part a) and b) of question 28, calculate the amount of thermal energy needed to heat 100 g of liquid water at 25.0ºC to water vapour at 100.0ºC. Assume that all the water evaporates. (1 mark)

Section III: Skills (10 marks)

|  |  |
| --- | --- |
| **Trial Number** | **Experimental Value of *H*fus** |
| 1 | 5.75 kJ/mol |
| 2 | 6.61 kJ/mol |
| 3 | 5.97 kJ/mol |

29. Rhys and Gareth complete an experiment to determine the experimental heat of fusion of water. They perform the experiment three times, and calculate the values given in the table for the experimental heat of fusion of water.

Given that the theoretical heat of fusion of water is 6.01 kJ/mol, what is the percent error for the average of the three trials? (4 marks)

*continued…*

|  |
| --- |
| Unit D—Energy Flow in Global Systems |

30. a) On a clean sheet of graph paper or with spreadsheet software, create climatographs for the following cities. (4 marks)

Banff, Latitude 51.1° N

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Month** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| **Temperature (°C)** | –5.3 | 0.1 | 3.8 | 9.0 | 14.2 | 18.7 | 22.1 | 21.6 | 16.1 | 10.1 | 0.5 | –5.3 |
| **Precipitation (mm)** | 31.0 | 23.9 | 21.5 | 32.4 | 57.5 | 60.0 | 51.2 | 51.3 | 43.8 | 30.3 | 30.4 | 34.6 |

Fort McMurray, Latitude 56.4° N

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Month** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| **Temperature (°C)** | –14.5 | –8.6 | –1.1 | 9.3 | 17.1 | 21.5 | 23.2 | 21.8 | 15.1 | 8.4 | –4.5 | –12.6 |
| **Precipitation (mm)** | 20.4 | 16.0 | 17.3 | 22.6 | 40.7 | 63.9 | 79.1 | 71.8 | 51.4 | 32.2 | 26.4 | 23.0 |

b) Use your climatographs to predict whether the cities will or will not have similar vegetation. Give reasons for your prediction. (2 marks)

Section IV: Written Response (10 marks)

31. Describe the relationship between the net radiation budget of a region and the type of biome that is likely to be found in that region. List the factors that can influence the net radiation budget. (5 marks)

32. Assess the risks and benefits of global warming to life in Alberta. (5 marks)

|  |
| --- |
| Unit D—Energy Flow in Global Systems |

Unit Test Answers

Section I: Multiple Choice

1. c)

2. a)

3. a)

4. d)

5. b)

6. c)

7. d)

8. d)

9. d)

10. d)

11. a)

12. d)

13. c)

14. b)

15. c)

16. c)

17. d)

18. a)

19. a)

20. c)

21. a)

22. b)

23. c)

24. a)

Section II: Numerical Response

25. *Q* = 500 ~~g~~ × 4.19 J/~~g·ºC~~ × 60.0~~ºC~~

=125 700 J

= 126 kJ

26. *c* = 4300 J ÷ (200 g × 50.0ºC)

= 0.430 J/g∙ºC

27. *n* = 1000 ~~g~~ ÷ 18.02 ~~g~~/mol

= 55.493 895 mol

*Q* = 55.493 895 ~~mol~~ × 6.01 kJ/~~mol~~

= 333.5183 kJ

= 334 kJ

28. a) *Q* = (100 ~~g~~)(4.19 J/~~g~~·~~ºC~~)(75.0~~ºC~~)

= 31 425 J

= 31.4 kJ

b) *Q* = (100 ~~g~~ ÷18.02 ~~g~~/mol) (40.7 kJ/mol)

*=* (5.5493895 ~~mol~~) (40.7 kJ/~~mol~~)

*=* 225.860 15 kJ

= 226 kJ

c) *Q* = 31.425 J + 225 860.15 J

= 257 285.15 J

= 257 kJ

Section III: Skills

30. Average of three trials = 6.11 kJ / mol, therefore, the percent error is 1.66%.

|  |
| --- |
| Unit D—Energy Flow in Global Systems |

31.a) Sample climatographs are shown below.

b) Students are likely to predict that these areas will have similar vegetation, since they have similar seasonal changes in temperature and precipitation. However, Fort McMurray in general is colder and drier, and so will not support frost- or drought-sensitive plants. Some students will note that Banff is located in a mountainous region, and that vegetation will vary from that of Fort McMurray as altitude increases.

Section IV: Written Response

32. The type of biome present at any location on Earth depends on the net radiation budget for that area. Factors that can influence this budget include latitude, albedo, atmospheric dust and cloud cover, insolation, and the length of daylight.

33. Answers will vary. Benefits of global warming to life in Alberta could include milder winters, increased habitat for some plants and animals, longer growing seasons, and greater crop yields. Negative impacts may include increased number of crop and forest pests, loss of habitat for some plants and animals, droughts, and impacts on human health.