Biology Unit Review

1) What type of microscope is used in our science labs? Compound light microscope

2) Briefly explain the functions of the following parts of a microscope:

   a) Eyepiece and ocular lens: Magnifies the object so that we can see it

   b) Objective lenses: Lets us chose the level of magnification we want to use

   c) Coarse adjustment: Makes large adjustments to the focus on a microscope

   d) Fine adjustment: Makes small adjustments to the focus on a microscope

3) Define the term "magnification": The enlarging of an image of an object to make it more visible

4) How do you calculate the total magnification of a microscope?

   (eyepiece)(objective lens) = (total magnification)

5) What happens to the size of the field of view (or field diameter) when the magnification of a microscope is increased?

   The size of the field of view (or field diameter) decreases.

6) What are the units of measurement (for length) that are typically used when we work with the lengths of cells in the field of view (or field diameter)? micrometers

7) Define the term "resolution". The amount of detail you can see in the image of an object.

8) REVIEW: HOW DO WE ESTIMATE THE SIZE OF A CELL UNDER A MICROSCOPE

9) What is "cell theory" and what are the three main points (or principles) of it?

That all living things are composed of one or more cells. Its 3 points are: the cell is the smallest unit of life, all life processes take place within cells, all cells reproduce by the process of cell division.

10) Explain what is meant by the term "spontaneous generation". Which scientist ended up permanently disproving this theory – in a rather famous experiment (for science at least).

It means that living things can arise from dead matter. Pasteur convincingly disproved this idea.

11) What are the four major chemical elements that make up cells? carbon, nitrogen, hydrogen, oxygen.

12) What are the four main types of compounds that these elements are organized into?

    Lipids (fats), proteins, carbohydrates, nucleic acids (DNA/RNA).

13) Know the functions of and be able to identify the following organelles in a cell: (see book)

   a) Cell membrane:
   b) Cytoplasm:
   c) Chloroplasts:
   d) Mitochondria:
   e) Nucleus:
   f) Lysosomes:
   g) Endoplasmic Reticulum:

14) What are some of the similarities and differences between plant and animal cells? (see text) but the key differences are that plant cells have a cell wall and a chloroplast – animal cells don't. There are numerous similarities!

15) What is the main role of the cell membrane (in either plant or animal cells)? To control the passage of materials into and out of the cell.

16) What are the components of the cell membrane? A diagram here might help you remember… Proteins embedded in a lipid layer (like chocolate chips embedded in the surface of the cookie dough)

17) What are the functions of the proteins imbedded in the cell membrane? To allow the passage of material into and out of the cell as well as help communicate with other cells in its environment.

18) Define the following terms:

   a) Permeable: anything can pass through
   b) Semi-permeable: only some things can pass through
   c) Impermeable: nothing can pass through

19) Modes of transport for materials across the cell membrane and cell environments:

   a) Passive (facilitated) Transport: diffusion along the concentration gradient that involves proteins "helping" materials across the cell membrane.

   b) Diffusion: the movement of materials from areas of higher concentration to areas of lower concentration.

   c) Osmosis: the movement of water from an area of higher concentration to an area of lower concentration across a semi-permeable membrane.

   d) Hypertonic environment: An environment with a LOWER concentration of water then the cell. Means the cell loses water and shrinks in size.

   e) Hypotonic environment: An environment with a HIGHER concentration of water then the cell. Means the cell gains water and swells in size.

   f) Isotonic environment: An environment where the concentration of water inside the cell is EQUAL to the concentration of water outside the cell.

g) Active Transport: The movement of materials from an area of lower concentration to an area of higher concentration (requires energy).

h) Endocytosis: The absorption of a particle by the cell membrane.
i) Exocytosis: The expulsion of a particle by the cell membrane.

20) Why do cells generally remain (and stay) very small. What advantages are there to being small for cells… because as a cell gets larger, its volume increases much more rapidly then its surface area – meaning the cell needs to absorb/remove more materials through proportionally less cell membrane (becomes less efficient).

21) KNOW: How to calculate the surface area to volume ratio for simple shapes (like a cube for example).
22) Describe three advantages that multi-cellular organisms have over unicellular organisms?
Division of Labor, Size and Interdependence

23) State the function of the following structures in plants:

a) Stomata and guard cells: control the size of the openings in the leaf to allow for gas exchange

b) Xylem: transports water and nutrients from roots to the leaves

c) Phloem: transports sugar from leaves to the rest of the plant

24) Define the terms adhesion and cohesion and how they apply to water moving up a plant.

Adhesion – the "sticking" of a material onto a different material.
Cohesion – the ability of a material to "stick" to itself. They both help water move it's way up the thin xylem tubes of a plant against the force of gravity.

25) The balanced chemical formula for photosynthesis is:
$6\ H_2O_{(l)} + 6\ CO_{2(g)} \rightarrow C_6H_{12}O_{6(aq)} + 6\ O_{2(g)}$
26) Complete the following table for photosynthesis and cellular respiration:

	Photosynthesis	***Cellular Respiration***
Do they occur in plant cells, animal cells or both	PLANTS	BOTH
The cell organelle responsible for performing this chemical process	CHLOROPLASTS	MITOCHONDRIA
Type of Input Energy Examples of which are chemical, electrical, kinetic, nuclear, potential and solar.	SOLAR (LIGHT)	CHEMICAL
Type of Output Energy Examples of which are chemical, electrical, kinetic, nuclear, potential and solar.	CHEMICAL	CHEMICAL (ATP)
Chemical Reactants	WATER AND CARBON DIOXIDE	GLUCOSE AND OXYGEN
Chemical Products	GLUCOSE AND OXYGEN	WATER AND CARBON DIOXIDE

Chemistry Unit Review

1) Know your WHMIS symbols!

2) List three examples of physical properties of matter: there are plenty, go with ductility, conductivity, and solubility

3) List two chemical properties of matter: flash point and reactivity with oxygen, acids, etc.

4) A physical change produces… a new state

5) A chemical change produces… a new substance

6) The "staircase" line on the Periodic Table separates the… metals and nonmetals

7) On the periodic table, the elements are arranged according to their… chemical properties

8) Identify the three parts of the atom and where they are located

Protons and neutrons are in the nucleus, electrons surround the nucleus.

9) How many neutrons are there in ^{23}Na (or sodium-23) => 23 – 11 = 12 neutrons

10) Draw the Bohr model for neutral nitrogen (it will have 2e- then 5e-)

11) Draw the Bohr Model for the nitrogen ion (nitride) (it will have 2e- then 8e-)

12) List the four main properties of ionic compounds: high melting point, crystalline, conductive in solution, soluble in solution

13) List three main properties common to most molecular compounds: mostly insoluble in water, lower melting points, not conductive in solution.

14) List three properties of acids: pH below 7, sour tasting, react with metals to form H_2 gas

15) List three properties of bases: pH above 7, bitter tasting, will NOT react with metals at all

16) Find the chemical name, chemical formula and solubility for the compounds in the table below.

Chemical Name	Chemical Formula	Solubility
magnesium fluoride	MgF_2	(aq)
iron (II) sulfate	$FeSO_4$	(aq)
sodium hydroxide	NaOH	(aq)
copper (I) oxide	Cu_2O	(s)

ammonium carbonate	$(NH_4)_2CO_3$	(aq)
lithium phosphide	Li_3P	(aq)
zinc benzoate	$Zn(C_6H_5COO)_2$	(s)
lead (IV) bromide	$PbBr_4$	(aq)

17) Following a chemical reaction between two aqueous ionic compounds, a solid precipitate formed in the solution. Of the compounds listed below, the only one that could be a precipitate in such a reaction is:

a) Lithium phosphate
b) Potassium nitrate
c) Silver sulphate
d) Sodium chloride

18) What is the chemical formula for lead (IV) oxide? PbO_2

19) $HNO_{3(aq)}$ is commonly used in the production of fertilizers. The correct <u>name</u> for this chemical is:
Hydrogen nitrate (or nitric acid)

20) Which of the following is an ionic compound?
a) CH_3OH
b) $CaCO_3$
c) CCl_4
d) CH_4

21) $2\ NH_4OH + H_2SO_4 \rightarrow (NH_4)_2SO_4 + 2\ H_2O$ is an example of a(n) neutralization (DR) reaction.

22) REVIEW: Know all the reaction types AND how to predict the products of each reaction type!!!

23) Balance this chemical reaction:

$3\ Ca(NO_3)_{2(aq)} + 2\ Na_3PO_{4(aq)} \rightarrow 1\ Ca_3(PO_4)_{2(s)} + 6\ NaNO_{3(aq)}$

24) Balance the following chemical equations:

a) $1\ Sn + 2\ CuSO_4 \rightarrow 2\ Cu + 1\ Sn(SO_4)_2$

b) $2\ Al + 3\ Br_2 \rightarrow 2\ AlBr_3$

c) $1\ Sr(OH)_2 + 2\ HNO_3 \rightarrow 1\ Sr(NO_3)_2 + 2\ HOH$

d) $2\ Na_2S + 1\ Sn(NO_3)_4 \rightarrow 4\ NaNO_3 + 1\ SnS_2$

e) $1\ N_2 + 3\ H_2 \rightarrow 2\ NH_3$

calcium bromide	$CaBr_2$	(aq)
zinc permanganate	$Zn(MnO_4)_2$	(s)

f) $1\ H_3PO_4 + 3\ NH_4OH \rightarrow 3\ HOH + 1\ NH4)_3PO_4$

25) For the following word equations, write the balanced chemical equations. Make sure you wire the correct compounds, include the states of matter and correctly balance them. Watch out for polyatomic elements!

a) solid sulfur + oxygen gas → sulfur dioxide gas

$1\ S_{8(s)} + 8\ O_{2(g)} \rightarrow 8\ SO_{2(g)}$

b) aqueous lead(II) nitrate + aqueous potassium iodide → solid lead (II) iodide + aqueous potassium nitrate.

$1\ Pb(NO_3)_{2(aq)} + 2\ KI_{(aq)} \rightarrow 1\ PbI_{2(s)} + 2\ KNO_{3(aq)}$

26) For the following chemical reactions
- Indicate the <u>type of chemical reaction</u> as formation (F), decomposition (D), hydrocarbon combustion (C), single replacement (SR), or double replacement (DR)
- <u>Complete</u> the chemical reaction by predicting the correct products AND their chemical state
- <u>Balance</u> the chemical reaction with the simplest whole number coefficients

a) C $1\ C_5H_{12(l)} + 8\ O_{2(g)} \rightarrow 5\ CO_{2(g)} + 6\ H_2O_{(g)}$

b) SR $1\ Cu_{(s)} + 1\ Ag_2SO_{4\ (aq)} \rightarrow 2\ Ag_{(s)} + 1\ CuSO_{4\ (aq)}$

c) D $2\ HgO_{(s)} \rightarrow 2\ Hg_{(l)} + 1\ O_{2\ (g)}$

d) DR $1\ ZnSO_{4(s)} + 1\ Cu(NO_3)_{2(aq)} \rightarrow 1\ ZnSO_{4(s)} + 1\ Cu(NO_3)_{2(aq)}$

e) F $2\ Mg_{(s)} + 1\ O_{2(g)} \rightarrow 2\ MgO_{(s)}$

27) Turn the following word equations into balanced chemical equations

a) solid potassium metal reacts with a solution of aluminum chloride

$3\ K_{(s)} + 1\ AlCl_{3\ (aq)} \rightarrow 1\ Al_{(s)} + 3\ KCl_{(aq)}$

b) solid sulfur reacts with oxygen to produce sulfur dioxide gas

$$1\ S_{8(s)} + 8\ O_{2(g)} \rightarrow 8\ SO_{2(g)}$$

28) Calculate the molar mass for the following compounds. You must show your ALL of your work!

a) Zn = 65.39 g/mol
b) P_4 = 123.88 g/mol
c) H_2O = 18.02 g/mol
d) $Ca(OH)_2$ = 74.10 g/mol

29) The mass of <u>three</u> moles of solid ammonium chloride is:

a) 50.47 g
b) 53.50 g
c) 102.96 g
d) 160.50 g

32) The heating capacity of water is 4.19 J/g°C. How much thermal energy would have to be absorbed for 65.0 g of water to change in temperature by 45.0°C?

Q = (65)(4.19)(45) = 12255.8 J = 1.23×10^4 J

33) Determine the quantity of energy needed to warm a 1.00 kg block of ice from – 15.0°C to 0.0°C if the specific heating capacity of ice is 2.00 J/g°C.

Q = (1000)(2.00)(15) = 30000 J = 3.00×10^4 J

34) A 3000 g sample of water was heated with 2.55×10^5 J of heat energy. Find the chance in temperature of the water. (c = 4.19 J/g°C).

2.55×10^5 J = (3000)(4.19)(Δt) => Δt =(255,000)/(12570) = 20.3°C

35) A 220 g stainless steel pot is used to warm 1500 g of water from 72°C to 97°C. Calculate the amount of heat required to heat BOTH the pot and the water if the specific heat capacity of water is 4.19 J/g°C and the specific heat capacity of steel is 0.510 J/g°C.

Q_{pot} = (220)(0.510)(25) = 2805 J
Q_{water} = (1500)(4.19)(25) = 157125 J
Q_{total} = 2805 + 157125 = 159,930 J = 1.6×10^5 J

36) How is the "heat of fusion or vaporization" different then the specific heat capacity for a substance?

Specific heat capacity deals with temperature changes. Heat of Fusion and Vaporization deal with phase (state) changes.

37) Why is there <u>no change</u> in temperature during fusion or vaporization?

Because all the energy that is added during these processes is used to transform the material into a different state (not used to raise its temperature).

38) How much heat is required to melt 500.0 g of ice (H_{fus} of water is 6.02 kJ/mol, H_{vap} of water is 40.7 kJ/mol)

$n = {}^{m}/_{M}$
$n = {}^{500}/_{18.02}$

n = 27.75 mol

Q = (27.75 mol) x (6.02 kJ/mol)
Q = 167 kJ or about 167,000 J

Physics Unit Review

1) Briefly define the following terms and make sure to include the UNITS they are typically measured in (if they are measured in any units at all).

a) Vector: any quantity that has both a magnitude AND a direction associated with it. Examples of vectors are: displacement, velocity, acceleration, force and work.

b) Distance: the measurement of how far an object has traveled. (measured in units like: m, km)

c) Displacement: the measurement of how much an object has changed its position relative to where it started. (measured in units like: m, km)

d) Speed: the measurement of how quickly an object is traveling over time. (measured in units like: m/s and km/hr)

e) Velocity: the measurement of how quickly an object is changing its position relative to a starting point over time. (measured in units like: m/s and km/hr)

f) Acceleration: the measurement of how much an object is CHANGING its speed or velocity over time. (measured in m/s^2)

g) Force: a push or pull acting on an object. (measured in N)

h) Work: a force acting on an object over a distance. (measured in J)

i) Uniform Motion: an object traveling in the same direction at a constant speed or velocity.

j) Potential Energy: the energy stored in an object due to its: height above the earth (gravitational), chemical bonds (chemical), or stored within the nucleus of an atom (nuclear) that is capable of doing work if it is released

k) Kinetic Energy: the energy an object contains due to its motion.

l) Mechanical Energy: the sum of the energy an object contains due to its motion and its position above the earth.

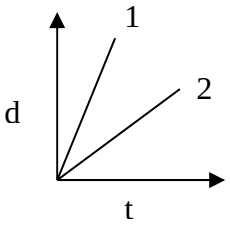
m) Efficiency: the percentage of input energy that is converted to USEFUL output energy. It can never be equal to or above 100%

2) Classify each of the following terms as either scalar (S) or vector (V) quantities:

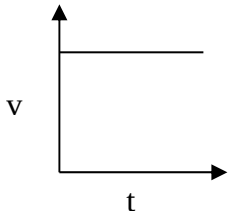
S distance traveled
V displacement
S speed
V velocity
V acceleration
S work
S energy
V force

3) Consider the following graphs:

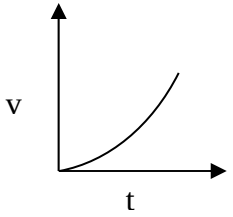
Graph A



Graph B



Graph C



a) Which object in Graph A is moving the fastest? Graph 1

b) Does the slope of Graph A illustrate the object's speed or velocity? Speed (as it is a distance time graph)

c) Which graphs illustrate uniform motion? Graphs A and B

d) What type of motion does Graph C show? Accelerated Motion

e) Considering the labels on the axis on Graph C, what physics formula is being represented by the slope of this graph? Well, the slope of this graph is velocity divided by time, and that is acceleration.

4) A ball rolls 10.0 m [S] in a time of 6.00 s, hits a wall and rolls back a distance of 15.0 m [N] in a time of 10.00 s. Determine:

a) The distance traveled: 25m
b) The final displacement: 5 m [N]
c) The average speed: 1.56 m/s
d) The average velocity: 0.31 m/s [N]

5) A shuttle craft accelerates from rest to a velocity of 50m/s [upwards] in 4.00 s. What is its rate of acceleration?

Acceleration = change in velocity / time Acceleration = (50 m/s [up]) / (4 s) = **12.5 m/s^2 [up]**

6) A car travels at a speed of 45 km/h then speeds up to 95 km/h in 20s. Find the car's rate of acceleration.

V_i = 45 km/h = 12.5 m/s
V_f = 95 km/h = 26.4 m/s
t = 20 s
a = ?

a = (26.4 m/s – 12.5 m/s) / 20 s
= (13.9 m/s) / 20 s = **0.695 m/s^2**

7) A boy on a bike is traveling at a velocity of 20 km/h [W] and comes to a stop in 1.0 minute. What was the bike's rate of acceleration (deacceleration in this case)?

V_i = 20 km/h = 5.55 m/s
V_f = 0 km/h = 0 m/s
t = 60 s
a = ?

a = (0 m/s – 5.55 m/s) / 20 s
= (-5.55 m/s) / 60 s = **0.093 m/s²**

8) What force is required to move a 50.0 kg object at an acceleration of 56.5 m/s²?

m = 50.0 kg
a = 56.5 m/s²
F = ?

F = (50.0 kg) x (56.5 m/s²)
= **2825 N**

9) A force of 65 N is required to move a rock at 16.2 m/s². What is the rock's mass?

m = ? kg
a = 16.2 m/s²
F = 65 N

m = (65 N) / (16.2 m/s²)
= **4.0kg**

10) A furniture mover applied a force of 75 N to move a chair that weighed 65 kg. What was the rate of acceleration as it moved across the floor?

m = 65 kg
a = ? m/s²
F = 75 N

a = (75 N) / (65 kg)
= **1.15 m/s²**

11) Calculate the work required to move a 15.5 kg child off the floor a distance of 1.15 m off of the floor?

m = 15.5 kg
a = 9.81 m/s² ← fighting gravity
d = 1.15 m
W = ?

W = (15.5 kg) x (9.81 m/s²) x (1.15 m)
= **174.9 J**

12) Joe used a force of 95.00 N to give Joanne a piggyback ride for a distance of 21.0 m. How much work did Joe do?

F = 95 N
d = 21.0 m
W = ?

W = (95 N) x (21.0 m)
= **1995 J**

13) A hunter stretched a bowstring back a distance of 0.265 m with a force of 78.5 N. What was the elastic potential energy of the drawn bow?

F = 78.5 N
d = 0.265 m
$E_{p(elastic)}$ = ?

$E_{p(elastic)}$ = (78.5 N) x (0.265 m)
= **20.8 J**

14) A 40.0 g arrow was released from the bow at a speed of 16.5 m/s. What was the arrow's kinetic energy?

m = 0.040 kg
v = 16.5 m/s
E_k = ?

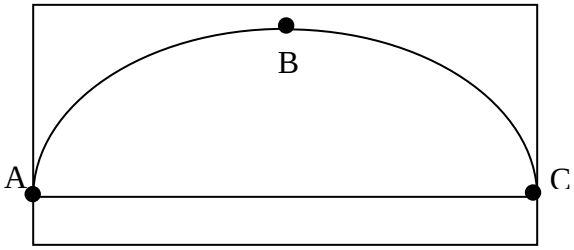
E_k = 0.5(0.040 kg) x (0.265 m/s)²
= **1.405 J**

15) If the kinetic energy of a 56.0 kg runner was 1250 J, what was his speed?

m = 0.040 kg
v = ? m/s
E_k = 1250 J

1250 = 0.5(56.0 kg) x (v)²
1250 = 28v²
44.64 = v²
v = 6.7 m/s

16) A kicker on the football team kicks a football that travels in the trajectory shown in the diagram below:



a) What main type of energy can be found at point A? **KINETIC ENERGY**

b) Where is the point in this system where the gravitational potential energy is highest? **Point B**

c) At what Point(s) is the kinetic energy the least? **Point B**

d) At what Point(s) is the gravitational potential energy the least? **Points A and C**

17) A 0.300 kg billiard ball is propelled from a table at a horizontal speed of 1.50 m/s. If the table is 1.30 m above the floor, what is the mechanical energy of the ball the moment it leaves the table?

m = 0.300 kg
v = 1.50 m/s
h = 1.30 m
g = 9.81 m/s²

$E_m = E_p + E_k$
E_m = (0.300)(9.81)(1.30) + (0.5)(0.300)(1.50)²
E_m = 3.826 J + 0.336 J
E_m = 4.164 J

18) A rock climber dropped his backpack that weighed 15.0 kg down the mountain. The backpack dropped 69.5 m. What was the speed of the pack as it fell down the mountain? Assume a frictionless environment and that $E_P = E_K$

m = 15.0 kg
v = ? m/s
h = 69.5 m
g = 9.81 m/s²

$E_p = E_k$
~~(15.0)~~(9.81)(69.5) = (0.5)~~(15.0)~~$(v)^2$
v^2 = 1363.59 m²/s²
v = 36.9 m/s

19) It takes 1.56 x 10^5 J of energy of fuel to start a car. If the motor's output energy is 4.52 x 10^4 J, how efficient is the motor?

E_{input}t = 15.0 kg
E_{output} = ? m/s
$\%_{Efficiency}$ = 69.5 m

$\%_{Efficiency}$ = (4.52 x 10^4 J) / (1.56 x 10^5 J) x 100%
= **29%**