Advanced Placement Biology

Notre Dame High School
Ms. Hope Bauch

Textbook Used: <u>Principles of Life, second edition</u>. Hillis, Sadava, Hill and Pierce

   This AP Biology course is designed to be the equivalent of a college introductory biology course usually taken by biology majors during their first year. AP Biology includes those topics regularly covered in a college biology course for majors and differs <u>significantly</u> from the usual first high school course in biology with respect to the kind of textbook used, the range and depth of topics covered, the kind of laboratory work done by students and the time and effort required of students. College biology majors also use the textbook used for AP biology and the labs done by AP students are equivalent to, or the same as, those done by college students.

   Therefore, the expectations are the same for AP biology students as college biology majors. There will be very few traditional homework assignments. You are expected to read the textbook and take notes on the chapters. This is in addition to any notes taken during class. AP Biology will consist of lectures, labs and essay writing. <u>If a student is absent for a lab, there will not be a make-up lab session,</u> so it is extremely important that you attend class regularly.

   The level of expectation for this type of course is very high. Only students who are committed to high standards of excellence will succeed. This course will provide you with the foundation needed to take and pass the AP Exam as well as prepare you for future college work. It is my hope that this coming year will be a learning experience for all of us. Get plenty of rest this summer and I look forward to working with you in September!

<u>Mandatory Summer Assignment:</u>

   You will find a summer STEM and Chemistry review packet at the end of this letter (after the explanation of the optional assignment) . This packet **must be completed and turned in by all students taking AP Biology. It is due on the 3rd day of classes. NO LATES WILL BE ACCEPTED!!! Failure to turn this in will result in a starting zero grade!** The packet will be graded for correctness and there is no penalty for guessing. Each of the problems is worth an equal amount of weight. The packet goes over topics that were covered in your pre-requisite classes of Honors Chemistry and STEM. I caution you, take this assignment very seriously. A good grade on this will help you in the beginning should you stumble on the first test. Please remember class policy, no late assignments are accepted. Failure to complete an assignment by the due date will result in a zero grade. Any questions, feel free email me at brennan@ndnj.org

Optional / Enrichment Assignment:

I have listed quite a few exceptional biology-based books below. These are not textbooks, but rather fascinating works of biology, virology, medicine, research and more. I encourage you to read as many of them as you can. I will allow you to turn in a summary (2-3 pages) of the book of your choice by the third day of class, for 200 points. I will discuss the book with you, read your summary and if I feel that you have truly read the book you will gain full credit. If you need further instructions for this assignment, feel free to contact me. Again, read as many as you like, but only one summary will be accepted. This summary, should you choose to do it, will be collected with the required summer packet.

- What is Life? Lynn Margulis and Dorion Sagan. ISBN 0-520-22021-8
- Genome. Matt Ridley. ISBN 0-06-019497-9
- The Blind Watchmaker. Richard Dawkins ISBN 0-393-31570-3
- The Selfish Gene. Richard Dawkins. ISBN 0-19-286092-5
- The Barmaid's Brain. Jay Ingram ISBN0-7167-4120-2
- Mean Genes.Terry Burnham and Jay Phelan ISBN 0-7382-0230-4
- The Agile Gene. Matt Ridley ISBN 0-06-000679-X
- Understanding the Human Genome Project. Michael Palladino ISBN 0-8053-6774-8
- Hot Zone. Richard Preston ISBN 0385479565
- Demon in the Freezer. Richard Preston ISBN 0345466632
- Virus of the CDC. Joseph McCormick and Susan Fisher-Hoch ISBN 0760712115
- The Coming Plague. Laurie Garrett ISBN 0140250913
- Guns, Germs and Steel, The Fates of Human Societies. Jared Diamond ISBN 0393317552
- Maneater. Pamela Nagami, M.D. ISBN 1580632092
- Stiff, The Curious life of Human Cadavers. Mary Roach. ISBN 0393324826
- Flu. Gina Kolata ISBN 0743203984
- The Seven Daughter of Eve. Bryan Sykes ISBN 0393020185
- The Immortal Life of Henrietta Lacks. Rebecca Skloot ISBN 9781400052172
- The Chimp and the River: David Quammen ISBN 9780393350845
- Spillover: David Quammen ISBN 9780393066807
- Outliers:The Stories of Success : Malcom Gladwell ISBN 9780316017923

AP Biology
Summer Assignment: A Review of STEM and Chemistry
If you feel you need more room, please place your labeled answers on a separate sheet.
Remember **SIG FIGS** count!!

Name_____

Please complete the following questions/scenarios/problems to the best of your ability:

1) Explain how you could experimentally determine whether the outside temperature is higher or lower than 0 °C (32 °F) without using a thermometer.

2) Identify each of the following statements as being most similar to a hypothesis, a law, or a theory. Explain your reasoning.
(a) Falling barometric pressure precedes the onset of bad weather.
(b) All life on earth has evolved from a common, primitive organism through the process of natural selection.
(c) My truck's gas mileage has dropped significantly, probably because it's due for a tune-up.

3) Why do we use an object's mass, rather than its weight, to indicate the amount of matter it contains?

4) How does a heterogeneous mixture differ from a homogeneous mixture? How are they similar?

5) Classify each of the following as an element, a compound, or a mixture:
(a) copper
(b) water
(c) nitrogen
(d) sulfur
(e) air
(f) sucrose
(g) a substance composed of molecules each of which contains two iodine atoms
(h) gasoline

6) When elemental iron corrodes it combines with oxygen in the air to ultimately form red brown iron(III) oxide which we call rust. (a) If a shiny iron nail with an initial mass of 23.2 g is weighed after being coated in a layer of rust, would you expect the mass to have increased, decreased, or remained the same? Explain. (b) If the mass of the iron nail increases to 24.1 g, what mass of oxygen combined with the iron?

7) Yeast converts glucose to ethanol and carbon dioxide during anaerobic fermentation as depicted in the simple chemical equation below:

glucose $\longrightarrow$ ethanol + carbon dioxide

(a) If 200.0 g of glucose is fully converted, what will be the total mass of ethanol and carbon dioxide produced?

8) A large piece of jewelry has a mass of 132.6 g. A graduated cylinder initially contains 48.6 mL water. When the jewelry is submerged in the graduated cylinder, the total volume increases to 61.2 mL.
(a) Determine the density of this piece of jewelry.

(b) Assuming that the jewelry is made from only one substance, what substance is it likely to be (use the provided density table)?

Densities of some common metals

Metal	Density (g/cm^3)
Aluminum	2.70
Copper	8.94
Gold	19.3
Iron	7.86
Lead	11.34
Magnesium	1.74
Silver	10.5
Tin	5.75
Zinc	7.14

9) Complete the following conversions between SI units.
(a) 612 g = _____ mg
(b) 8.160 m = _____ cm
(c) 3779 µg = _____ g
(d) 781 mL = _____ L
(e) 4.18 kg = _____ g
(f) 27.8 m = _____ km
(g) 0.13 mL = _____ L
(h) 1738 km = _____ m
(i) 1.9 Gg = _____ g

10) The gas tank of a certain luxury automobile holds 22.3 gallons according to the owner's manual. If the density of gasoline is 0.8206 g/mL, determine the mass in kilograms and pounds of the fuel in a full tank.

11) As an instructor is preparing for an experiment, he requires 225 g phosphoric acid. The only container readily available is a 150-mL Erlenmeyer flask. Is it large enough to contain the acid, whose density is 1.83 g/mL?

12) Solve these problems about lumber dimensions.
(a) To describe to a European how houses are constructed in the US, the dimensions of "two-by-four" lumber must be converted into metric units. The thickness × width × length dimensions are 1.50 in. × 3.50 in. × 8.00 ft in the US. What are the dimensions in cm × cm × m?

(b) This lumber can be used as vertical studs, which are typically placed 16.0 in. apart. What is that distance in centimeters?

13) The mercury content of a stream was believed to be above the minimum considered safe—1 part per billion (ppb) by weight. An analysis indicated that the concentration was 0.68 parts per billion. What quantity of mercury in grams was present in 15.0 L of the water, the density of which is 0.998 g/ml? $\left(1 \text{ ppb Hg} = \dfrac{1 \text{ ng Hg}}{1 \text{ g water}} \right)$

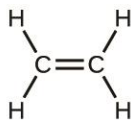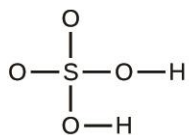14) Write the molecular and empirical formulas of the following compounds:
(a)

O=C=O

(b)

H—C≡C—H

(c)

(d)

15) Write a sentence that describes how to determine the number of moles of a compound in a known mass of the compound if we know its molecular formula.

16) Calculate the empirical or molecular formula mass and the molar mass of each of the following minerals:
(a) limestone, $CaCO_3$
(b) halite, $NaCl$
(c) beryl, $Be_3Al_2Si_6O_{18}$
(d) malachite, $Cu_2(OH)_2CO_3$
(e) turquoise, $CuAl_6(PO_4)_4(OH)_8(H_2O)_4$

17) Based on their positions in the periodic table, predict which has the smallest atomic radius: Mg, Sr, Si, Cl, I.

18) Based on their positions in the periodic table, predict which has the largest first ionization energy: Mg, Ba, B, O, Te.

19) Based on their positions in the periodic table, list the following atoms in order of increasing radius: Mg, Ca, Rb, Cs.

20) . Based on their positions in the periodic table, list the following ions in order of increasing radius: K^+, Ca^{2+}, Al^{3+}, Si^{4+}.

21) Predict which of the following compounds are ionic and which are covalent, based on the location of their constituent atoms in the periodic table:
(a) Cl_2CO
(b) MnO
(c) NCl_3
(d) $CoBr_2$
(e) K_2S
(f) CO
(g) CaF_2
(h) HI
(i) CaO
(j) IBr
(k) CO_2

22) . Explain the difference between a nonpolar covalent bond, a polar covalent bond, and an ionic bond.

23) From its position in the periodic table, determine which atom in each pair is more electronegative:
(a) Br or Cl
(b) N or O
(c) S or O
(d) P or S
(e) Si or N
(f) Ba or P

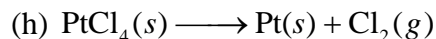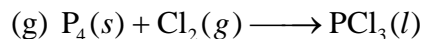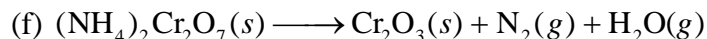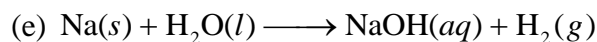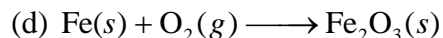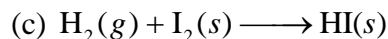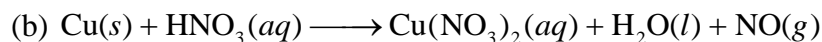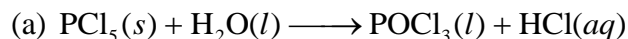24) Explain how a molecule that contains polar bonds can be nonpolar.

25) Calculate the following to four significant figures:
(a) the percent composition of ammonia, NH_3
(b) the percent composition of photographic fixer solution ("hypo"), $Na_2S_2O_3$
(c) the percent of calcium ion in $Ca_3(PO_4)_2$

26) Dichloroethane, a compound that is often used for dry cleaning, contains carbon, hydrogen, and chlorine. It has a molar mass of 99 g/mol. Analysis of a sample shows that it contains 24.3% carbon and 4.1% hydrogen. What is its molecular formula?

27) . Balance the following equations:

(a) $PCl_5(s) + H_2O(l) \longrightarrow POCl_3(l) + HCl(aq)$

(b) $Cu(s) + HNO_3(aq) \longrightarrow Cu(NO_3)_2(aq) + H_2O(l) + NO(g)$

(c) $H_2(g) + I_2(s) \longrightarrow HI(s)$

(d) $Fe(s) + O_2(g) \longrightarrow Fe_2O_3(s)$

(e) $Na(s) + H_2O(l) \longrightarrow NaOH(aq) + H_2(g)$

(f) $(NH_4)_2Cr_2O_7(s) \longrightarrow Cr_2O_3(s) + N_2(g) + H_2O(g)$

(g) $P_4(s) + Cl_2(g) \longrightarrow PCl_3(l)$

(h) $PtCl_4(s) \longrightarrow Pt(s) + Cl_2(g)$

28) Write a balanced molecular equation describing each of the following chemical reactions.
(a) Solid calcium carbonate is heated and decomposes to solid calcium oxide and carbon dioxide gas.

(b) Gaseous butane, C₄H₁₀, reacts with diatomic oxygen gas to yield gaseous carbon dioxide and water vapor.

(c) Aqueous solutions of magnesium chloride and sodium hydroxide react to produce solid magnesium hydroxide and aqueous sodium chloride.

(d) Water vapor reacts with sodium metal to produce solid sodium hydroxide and hydrogen gas

29) Write a balanced equation describing each of the following chemical reactions.
(a) Solid potassium chlorate, $KClO_3$, decomposes to form solid potassium chloride and diatomic oxygen gas.

(b) Solid aluminum metal reacts with solid diatomic iodine to form solid Al_2I_6.

(c) When solid sodium chloride is added to aqueous sulfuric acid, hydrogen chloride gas and aqueous sodium sulfate are produced.

(d) Aqueous solutions of phosphoric acid and potassium hydroxide react to produce aqueous potassium dihydrogen phosphate and liquid water.

30) Colorful fireworks often involve the decomposition of barium nitrate and potassium chlorate and the reaction of the metals magnesium, aluminum, and iron with oxygen.
(a) Write the formulas of barium nitrate and potassium chlorate.

(b) The decomposition of solid potassium chlorate leads to the formation of solid potassium chloride and diatomic oxygen gas. Write an equation for the reaction.

(c) The decomposition of solid barium nitrate leads to the formation of solid barium oxide, diatomic nitrogen gas, and diatomic oxygen gas. Write an equation for the reaction.

(d) Write separate equations for the reactions of the solid metals magnesium, aluminum, and iron with diatomic oxygen gas to yield the corresponding metal oxides. (Assume the iron oxide contains Fe^{3+} ions.)

31) Write the balanced equation for each of the following:
(a) The number of moles and the mass of chlorine, Cl_2, required to react with 10.0 g of sodium metal, Na, to produce sodium chloride, NaCl.

(b) The number of moles and the mass of oxygen formed by the decomposition of 1.252 g of mercury (II) oxide.

(c) The number of moles and the mass of sodium nitrate, $NaNO_3$, required to produce 128 g of oxygen. ($NaNO_2$ is the other product.)

(d) The number of moles and the mass of carbon dioxide formed by the combustion of 20.0 kg of carbon in an excess of oxygen.

(e) The number of moles and the mass of copper (II) carbonate needed to produce 1.500 kg of copper (II) oxide. (CO_2 is the other product.)

32) Determine the number of moles and the mass requested for each reaction in problem 31.