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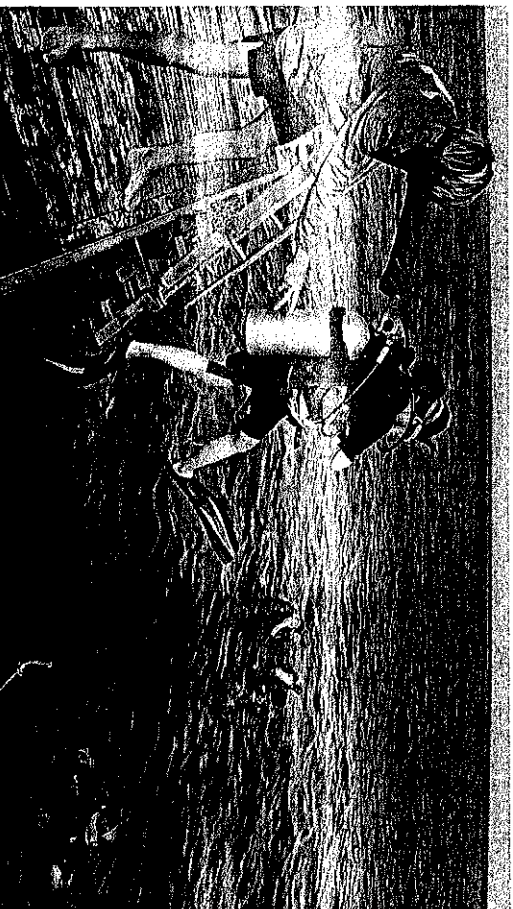
HS Science

Packet 3

May 4, 2020

The first map of ocean wilderness shows "nowhere is safe" from human impact

A scuba-diving tourist on the Ocean Freedom is helped into the water by a crew member at Australia's Great Barrier Reef, September 22, 2014. According to an Australian government report, the outlook for Earth's largest living structure is "poor," with climate change posing the most serious threat to the extensive coral reef ecosystem. Photo by: William West/AFP/Getty Images

The first comprehensive mapping of ocean wilderness revealed that no part of the ocean is untouched by humans, and only 13 percent could be classified as "wilderness."

"Nowhere is safe," said James Watson of the University of Queensland, an author of the study, in a video abstract for the report.

The exhaustive analysis of human impacts in all global marine ecosystems, published Thursday in Current Biology, categorized and mapped all the ways humans have changed the ocean, such as fishing, shipping and pollution.

The study scored each marine area according to the intensity, number and cumulative effect of human impact, building a map of the ocean and each geographic location's status. To be classified as "wilderness," the study defined the area as "mostly free of human disturbance."

The cumulative stresses on the ocean can be compared in some ways to human health. "If you've got a low-grade fever and a knife wound on your arm and a broken leg, and you start adding these things up, each one is pretty bad, but together you're in really bad shape. You need to hurry to the doctor. And that's the same idea as what we're talking about going on in the ocean," said Ben Halpern, an author of the study and a marine biology professor at the University of California at Santa Barbara.

"To me it is depressing," said Kendall Jones, lead author and a conservation planning specialist at the Wildlife Conservation Society. "Often you have a picture in your head of these wild places where people don't really go, and actually that's not the case. We go really everywhere now. There is not much of the ocean that remains as it once was."

Coastal areas are the most disturbed by humans, and they're also the most productive, Halpern said. For example, coral reefs and mangroves are near many cities, provide food and protection from wave damage, and are crowded with underwater life. Forty percent of the world's population lives near the ocean and depends heavily on its resources.

"We can only consider a few places today to be ... 'wild,' including coral reefs in the tropical Pacific and both poles, but these are already among the most vulnerable places on Earth to climate change," said Terry Hughes, a coral reef expert and professor at James Cook University who was not involved in the study.

Countries with "substantial wilderness" included New Zealand, Australia and Chile. The study says this may be due to low human populations. The Northern Hemisphere had very few designated wilderness zones.

Most wilderness areas were in the often-romanticized "high seas," according to the study.

"The Wild West frontier out there: They're so far away that people don't get to them very much. True remoteness helps keep some of these places in relative wilderness status," Halpern said.

With humans increasingly changing our planet, "nowhere in the sea is entirely free of human impacts," the authors said.

Jones said, "We know wilderness areas are really important for biodiversity and the planet, but at the moment no international agreements are working to protect them."

Biodiversity, or the variety of life on the planet, is important in its own right, said Jones, but it's also important for humanity.

"We depend on the ocean for an ever-growing proportion of our protein," and marine animals need large intact wilderness areas to recover and repopulate, he said.

With sea ice disappearing, more areas that currently count as wilderness could be lost, the authors said. New technologies now reach areas that were previously unreachable. Less than 5 percent of global marine wilderness is inside protected areas. About 7 percent of the total ocean is protected, regardless of wilderness status, and only a quarter of the world's coral reefs are protected.

The scientists ran their analysis twice: once with climate-change stressors and once without them. If they included the four defined climate stresses, it eliminated every place on the planet as wilderness. If climate change is included, the entire ocean is disturbed by people. The scientists

excluded the climate factors from some of their analysis to get the 13 percent remaining wilderness number, with areas being impacted but at low levels.

"We really need to do something about climate change. Its fingerprint on the ocean is vast and pretty much everywhere, and that's already creating all sorts of changes in the ocean that are having an impact, not just on nature, but on people too," Halpern said.

The authors called for better enforcement of existing fishing laws, and minimizing ocean-based mining and runoff from land activities.

"There still is time to make a difference. I still have hope for the oceans. It's not too late. Thirteen percent might not seem like that much, but that's a lot of area that's still relatively intact," Halpern said. "It just comes down to the will of the people and the politicians to care enough about the ocean to make these changes."

Quiz

1

How does the author connect climate change with the disappearance of ocean wilderness?

(A) by describing scientists' analyses with and without including climate change stressors, and noting the effect of disappearing sea ice

(B) by comparing the amount of shipping and pollution affecting the ocean now with the amount before climate change became apparent

(C) by analogizing the types of climate stresses being placed on the ocean with various injuries that can combine to harm human health

(D) by exploring the importance of coral reefs and mangroves, and emphasizing the role of climate change in coral bleaching events

2

According to the article, why do researchers believe international agreements to protect the ocean need to be created and enforced?

1. Government competition over wilderness areas has harmed marine life.
2. Humans rely on the biodiversity of the oceans as an essential food source.
3. Only a small percentage of the ocean is currently inside protected areas.
4. Existing laws are not being enforced as thoroughly as they could be.
5. Runoff from land activities is hurting the ocean.
6. Preserving the variety of life on the planet is important for its own sake.

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

(B) 2, 3, 4, 5 and 6

(C) 1, 2, 3 and 6

(D) 2, 4, 5 and 6

3

Read the list of phrases from the first five paragraphs of the article.

comprehensive mapping

exhaustive analysis

cumulative effect

Why does the author use these phrases in the article?

(A) They demonstrate a sense of anxiety about the negative and irreversible findings of researchers.

(B) They develop a sense of credibility regarding the sweeping and thorough conclusions of researchers.

(C) They convey a sense of admiration for the speed and accuracy of the researchers writing the report.

(D) They create a sense of impatience with readers who are not persuaded by the researchers' study.

ACT Science Mini Lesson #2-ACT Science Vocab

Although the ACT science section is not a true science exam, you will still benefit from an understanding of some key scientific terms. That being said, <u>DO NOT MEMORIZE!</u>

Absorption	Acid
Atom	Base
Calorie	Catalyst
Chemical reaction	Chlorophyll
Chromosome	Compound
Control	Constant
Density	Diffusion
DNA	Element
Evolution	Gas
Kinetic	Liquid
Malleable	Mass
Molecule	Nucleus
Organic	Permeability
pH	Photosynthesis
Protein	Radioactive
Reflection	Solid
Solution	Solvent
Viscous	Weight

<u>Linear Graphs</u>
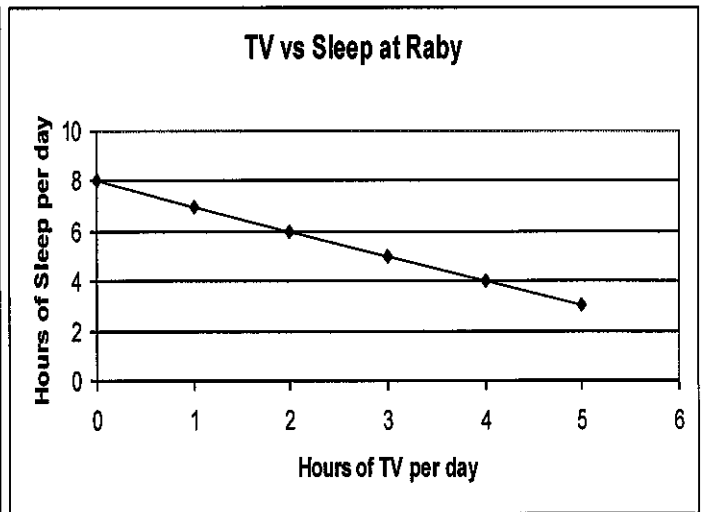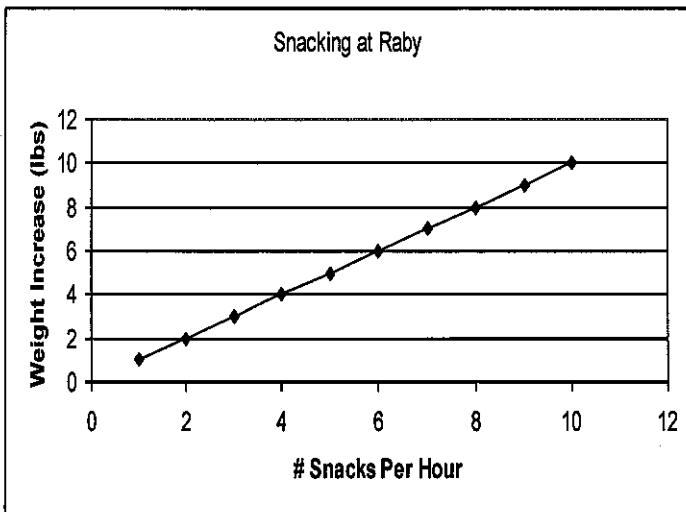
<u>Type 1</u>: Linear (Straight) Graphs

Positive Relationship = _____ Relationship = ALWAYS PUT A _____

Negative Relationship = _____ / _____ Relationship = ALWAYS PUT A _____
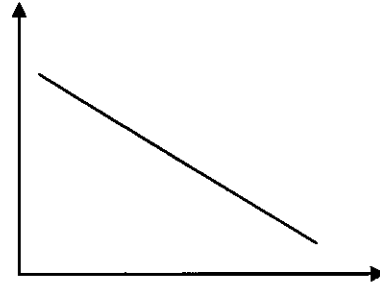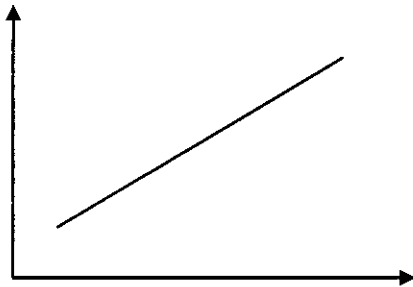
Example #1   **Example # 2**

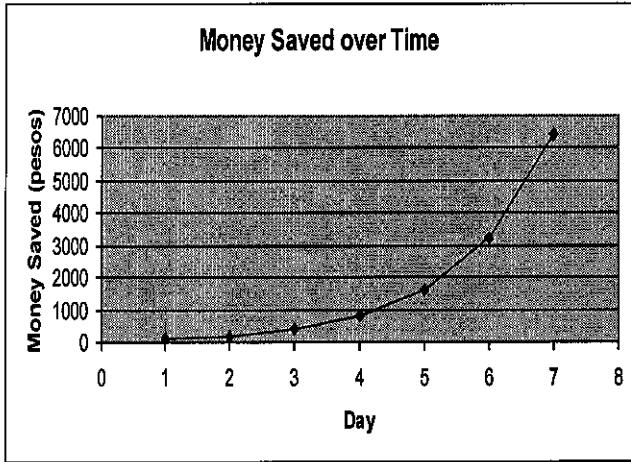
For each of the graphs above, identify the following:

	Example 1	Example 2
What are the variables?		
How are they measured?		
How are they related/changing?		

Graphs with Curves

Type 2: Curved (Nonlinear / Non-straight) Graphs

Still annotate with a + or a - Might need several +'s or −'s, or an OVERALL + & −.

Example #1

Money Saved over Time

A graph titled "Money Saved over Time" with y-axis labeled "Money Saved (pesos)" ranging from 0 to 7000, and x-axis labeled "Day" ranging from 0 to 8, showing an upward curving line.

	Example #1
What are the variables?	
How are they measured?	
How are they related/changing?	

Example #2

Real Median Household Income: 1967 to 2005

A line graph showing "2005 dollars" on the y-axis ranging from 0 to 50,000, and years from 1959 to 2005 on the x-axis. Values noted include $35,379 and $46,326. Recession periods are shaded.
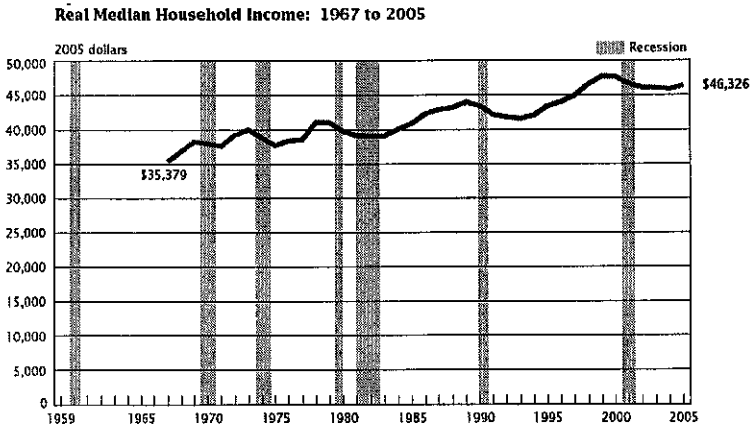
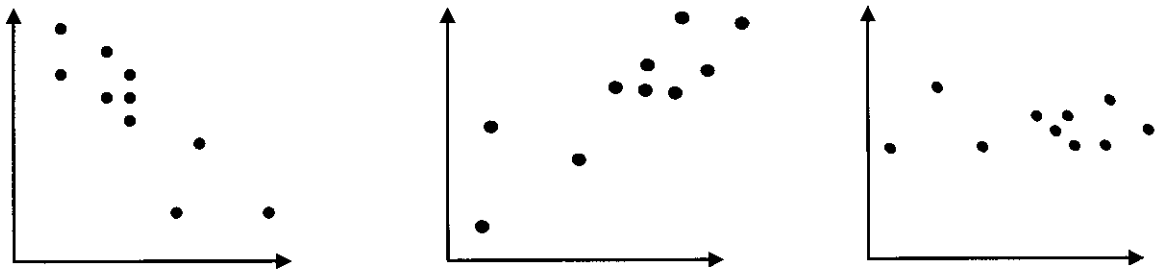|	Example #2
What are the variables?	
How are they measured?	
How are they related/changing?	

Steps to solving Scatter Plots

1. Still annotate with a   +/-/NR   .
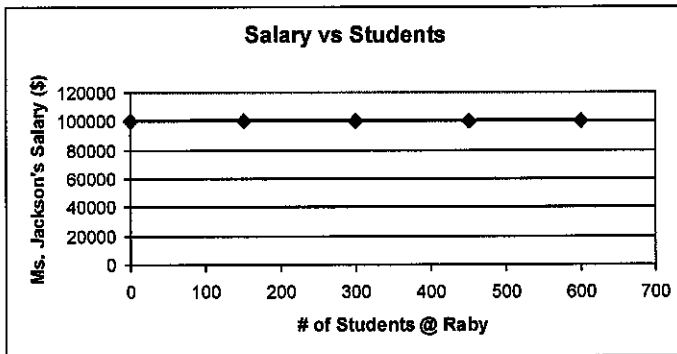2. Draw in the *LINE OF BEST FIT*

Drill:

Draw a line of best fit for the following scatter graphs

Flat Graphs

These graphs will not have a +/- relationship, but that does NOT mean that these variables are not related.

Example

	Example
What are the variables?	
How are they measured?	
How are they related/changing?	

Tables

You should have the same thought process for tables as you have for graphs.

Houses Sold in US over Time

Year	# Units (in 1000s)
1970	485
1975	549
1980	545
1985	688
1990	534
1995	667
2000	877
2005	1,283

Source: US Census Bureau, 2006

Lifting Strength vs. Muscle Diameter

Lifting Strength (N)	Muscle Diameter (cm)
50	24
43	20
40	19
20	15
12	12
5	6
2	4
1	3

Human CO_2 Output vs. Forest Size

CO_2 Output (kg)	Forest Size (ha)
10	2013
20	2010
30	2111
40	1983
50	1323
60	2100
70	2000
80	2001

	Example 1	Example 2	Example 3
What are the variables?			
How are they measured?			
How are they related/changing?			

Translating a Graph from a Table

Chymotrypsin Acidity: Temperature Dependence

Temp (°C)	pH Level
47	2
42	5
37	7
32	4
27	3
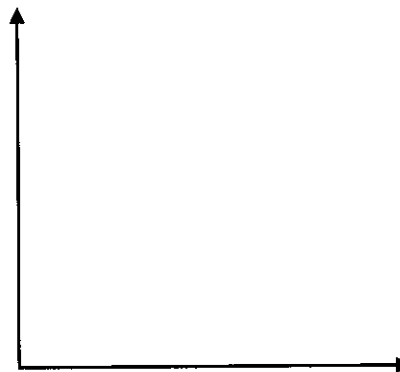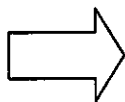
Don't Forget:

- Title
- Labels for variables
- Scale

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Four test landfill sites were prepared to determine the effect of industrial wastes on water absorption, alkalinity, and metal concentrations. All four sites contained the same amount and type of municipal waste and were located within a mile of one another. Site 1 was used as a control and no additional material was added. Sewage sludge was added to Site 2, battery production waste was added to Site 3, and inorganic pigment waste was added to Site 4. Over the course of a year, measurements were taken to determine what percent of the maximum water capacity the site had maintained. Scientists measured each site's alkalinity, and its concentration of copper and nickel.

Table 1 Concentrations in mg per kg

	Alkalinity	Nickel	Copper
Site 1	2080	182	17
Site 2	5820	236	36
Site 3	3008	287	53
Site 4	4420	938	134

Figure 1

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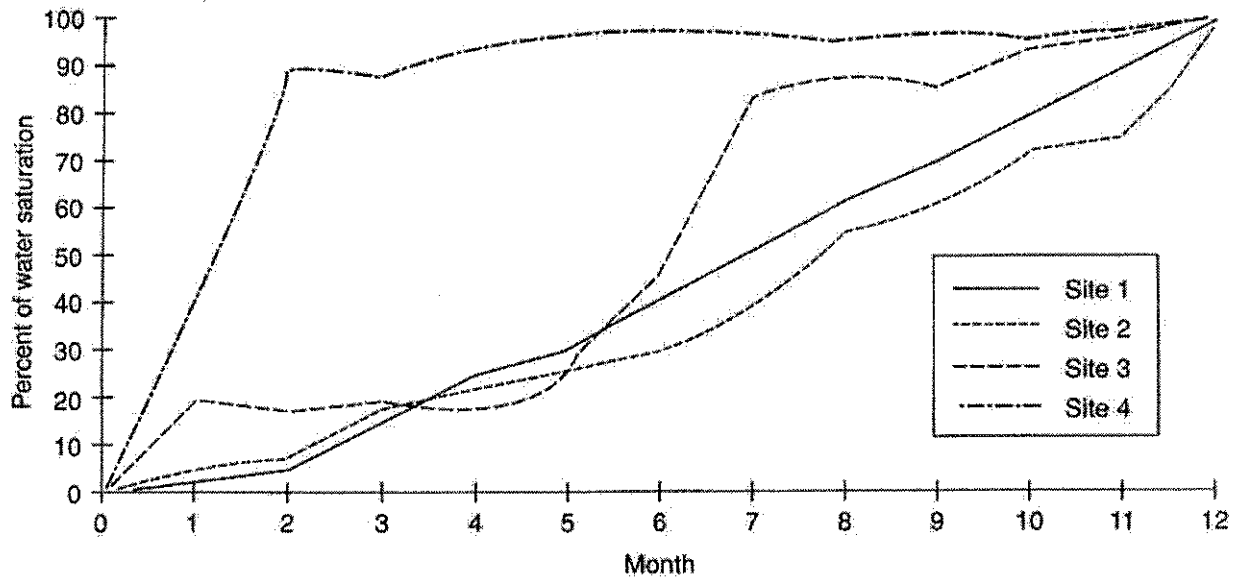
1. According to the study, the best model for studying the effects of increased copper concentration in landfills would be a site that:

A. only contains municipal waste.
B. receives wastes from an inorganic pigment factory.
C. receives wastes from a battery factory.
D. is very alkaline.

2. Which of the following best describes the pattern of water saturation seen in Figure 1?

F. Site 1 was saturated with water more quickly than the other sites.
G. Site 4 was saturated with water more quickly than the other sites.
H. Site 3 was saturated with water at about the same rate as Site 2.
J. Site 2 was saturated with water at about the same rate as Site 4.

3. What conclusion can be drawn from the results in Figure 1?

A. More rain fell on Sites 3 and 4 than on Sites 1 and 2.
B. The municipal waste was more porous in Site 3 than in the other sites.
C. Adding battery waste decreases the amount of time for saturation to occur.
D. Site 3 absorbed water at about the same rate for all twelve months.

4. On the basis of these experimental results, which of the following is least likely to delay the saturation of a landfill site?

F. Increasing the amount of copper
G. Adding sewage sludge
H. Increasing alkalinity
J. Adding inorganic pigment

5. Suppose that scientists created a fifth test site and added about half the amount of battery production waste that was added to Site 3. When compared to Site 1, saturation in the new site will probably occur:

A. more quickly, because adding battery waste speeds up saturation.
B. more slowly, because adding battery waste increases the concentration of nickel.
C. more quickly, because adding battery waste greatly increases alkalinity.
U. more slowly, because adding battery waste slows down saturation.

6. The alkalinity of a site was most affected by:

F. municipal refuse.
G. sewage sludge.
H. battery production waste.
J. inorganic pigment waste.

Name_____

1.

2. Define *conservation.*

3. Define *fossil fuels* and give three examples.

4. Define *nuclear waste.*

5. Define *hydroelectricity.*

6. Give 3 examples of *renewable* and *nonrenewable resources.*

7. Explain how temperature affects the speed of sound waves.

8. Explain how frequency affects a sound wave.

9. Explain the *Doppler Effect.*

10. Define *transparent, translucent,* and *opaque.*

11. What are the *primary pigments?*

12. Compare *fluorescent* and *incandescent* lights.

13. Define *reflection* and *refraction.*

14. Describe *plane, concave,* and *convex mirrors* and what kind of images they form.

15. Describe *concave* and *convex lenses* and what kind of images they form.

16. Describe *solids, liquids,* and *gases* in terms of shape and volume.

17. Define *homogeneous* and *heterogeneous* mixtures and give examples of each.

18. Explain the *Tyndall effect.*

19. Define *colloid* and give examples.

20. Define *physical* and *chemical changes* and give examples.

21. Define *physical* and *chemical properties* and give examples.

I. Define the following vocabulary terms.
Atmosphere, barometer, boiling point, colligative properties, colloid, concentration, condensation, crystalline solid, Dalton's law of partial pressures, deposition, diffusion, elastic collision, electrolyte, evaporation, freezing point, Graham's law of effusion, kinetic-molecular theory, melting point, molality, molarity, osmosis, osmotic pressure, pascal, phase diagram, pressure, saturated, soluble, solubility, solute, solution, solvent, sublimation, surface tension, supersaturated, suspension, temperature, thixotropic, triple point, turbidity, unsaturated, vapor pressure, vaporization, viscosity

II. Solve the following mole conversion problems. Show your work and write all answers in scientific notation with the correct number of significant figures.

1) How many sodium atoms are there in 48.7 moles of sodium?

2.93×10^{25} atoms

2) How many moles are found in 83.3 g of H_2SO_4?

8.49×10^{-1} mol

3) 3.82×10^{27} atoms of lead are how many moles of lead?

6.35×10^{3} mol

4) What is the mass of 5.7 moles of iodine?

7.2×10^{2} g

5) What is the mass of 2.98×10^{27} atoms of boron?

5.35×10^{4} g

6) How many moles are in 9.34×10^{22} atoms of $C_{13}H_{18}O_2$?

1.55×10^{-1} mol

7) How many atoms are in 104.3 g of sulfur?

1.96×10^{24} atoms

8) What is the percent composition of $C_8H_{10}N_4O_2$?

49.47% C, 5.20% H, 28.85% N, 16.48% O

9) What is the empirical formula of a compound that contains 63.5 g of silver, 8.25 g of nitrogen, and 28.26g of oxygen?

$AgNO_3$

10) Glycerol has a percent composition of 39.12% carbon, 8.75% hydrogen, and 52.12% oxygen. The molar mass is 92.11 g/mol. What is the molecular formula for glycerol?

$C_3H_8O_3$

III. Solve the following stoichiometry problems. Show your work and write all answers in scientific notation with the correct number of significant figures.

11) The reaction between solid sodium and iron(III) oxide is one in a series of reactions that inflates an automobile airbag. How many moles of sodium will be needed to form 7.8 mol of iron?

$$6Na(s) + Fe_2O_3(s) \rightarrow 3Na_2O(s) + 2Fe(s)$$

23 mol Na

12) The equation representing the production of tetraphosphorus trisulfide (P_4S_3), a substance used in some match heads is given below. How many moles of sulfur are needed to produce 923 g of tetraphosphorus trisulfide?

$$8P_4 + 3S_8 \rightarrow 8P_4S_3$$

1.57 mol S_8

13) The equation for the production of glucose is given below. What mass of glucose is produced if 102.3 g of water reacts?

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

170.5 g $C_6H_{12}O_6$

14) A solution of potassium chromate reacts with a solution of lead(II) nitrate to produce a yellow precipitate of lead(II) chromate and a solution of potassium nitrate. Starting with 0.250 mol potassium chromate, determine the mass of lead chromate that can be obtained.

$$K_2CrO_4(aq) + Pb(NO_3)_2(aq) \rightarrow PbCrO_4(s) + 2KNO_3(aq)$$
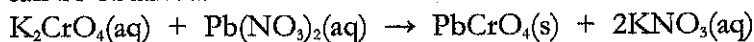
80.8 g PbCrO$_4$

15) The exothermic reaction between liquid hydrazine (N_2H_4) and liquid hydrogen peroxide (H_2O_2) is used to fuel rockets. The products of this reaction are nitrogen gas and water.
(a) Write the balanced chemical equation.

$$N_2H_2(l) + H_2O_2(l) \rightarrow N_2(g) + 2H_2O(l)$$
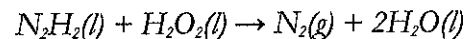
(b) How many grams of hydrazine are needed to produce 10.0 mol nitrogen gas?

3.00×10^2 g N$_2$H$_2$

16) Car batteries use solid lead and lead(IV) oxide with sulfuric acid solution to produce an electric current. The products of this reaction are lead(II) sulfate in solution and water. Determine the mass of lead(II) sulfate produced when 25.0 g lead reacts with an excess of lead(IV) oxide and sulfuric acid.

$$Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(aq) + 2H_2O(l)$$
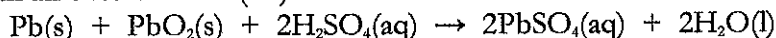
73.4 g PbSO$_4$

17) Lithium reacts spontaneously with bromine to produce lithium bromide. If 25.0 g of lithium and 25.0 g of bromine are present at the beginning of the reaction, determine
(a) the limiting reactant

Br$_2$

(b) the excess reactant and the mass in excess

Li, 22.8 g

(c) the mass of lithium bromide produced

27.1 g LiBr

(d) the percent yield if product if only 26.4 g of lithium bromide is produced

97.4%

IV. Solve the following gas pressure problems. Show your work and write answers in the correct number of significant figures.

$$\frac{Rate_A}{Rate_B} = \sqrt{\frac{molar\ mass_B}{molar\ mass_A}} \qquad P_{total} = P_1 + P_2 + P_3 + \ldots P_n$$

18) Calculate the ratio of effusion rates for nitrogen (N_2) and water (H_2O).

0.8019

19) Calculate the diffusion rate for oxygen (O_2) if hydrogen (H_2) diffuses at 2.34 mol/min.

0.588 mol/min

20) Find the total pressure for a mixture that contains four gases with partial pressures of 14.9 kPa, 3.97 kPa, 10.1 kPa, and 9.04 kPa.

38.0 kPa

21) What is the partial pressure of oxygen gas in a mixture of oxygen, hydrogen, and helium if the total pressure is 832 mm Hg, the partial pressure of hydrogen is 428 mm Hg, and the partial pressure of helium is 178 mm Hg.

226 mm Hg

V. Solve the following gas law problems. Show your work and write all answers in the correct number of significant figures.

$P_1V_1 = P_2V_2$	$V_1/T_1 = V_2/T_2$	$P_1/T_1 = P_2/T_2$	$P_1V_1/T_1 = P_2V_2/T_2$
$PV = nRT$	$M = mRT/PV$	$D = MP/RT$	1 mol = 22.4 L

22) A sample of gas of unknown pressure occupies 0.766 L at a temperature of 298 K. The same sample of gas is then tested under known conditions and has a pressure of 80.3 kPa and occupies 0.533 L at 305 K. What was the original pressure of the gas?

23) How many grams of carbon dioxide gas are in a 1.5 L balloon at STP?

2.9 g CO_2

24) The volume of a gas at 89.0 kPa is 350.0 mL. If the pressure is increased to 188 kPa, what will be the new volume?

166 mL

25) Calculate the volume of oxygen gas at STP that is required to completely react with 67.0 g of iron.

$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$$

20.2 L O_2

26) A gas at 89°C occupies a volume of 0.67 L. At what Celsius temperature will the volume increase to 1.12 L?

330°C

27) What volume of water vapor is produced during the combustion of 34.0 L of ammonium nitrate?

$$NH_4NO_3(g) \rightarrow N_2O(g) + 2H_2O(g)$$

68.0 L H_2O

28) The pressure in an automobile tire is 1.88 atm at 25.0°C. What will be the pressure if the temperature warms up to 37.0°C?

1.96 atm

29) Determine the volume of a container that holds 3.4 mol of a gas at STP.

76 L

30) What is the pressure in atmospheres of a 0.192 mol sample of helium gas at a temperature of 25.0°C if its volume is 0.464 L?

10.1 atm

31) What is the pressure of a fixed volume of a gas at 47.0°C if it has a pressure of 1.04 atm at 32.0°C?

1.09 atm

VI. Solve the following solubility and concentration problems. Show your work and write all answers in the correct number of significant figures with correct units.

$S_1/P_1 = S_2/P_2$	$M_1V_1 = M_2V_2$	$X_A = n_A / (n_A + n_B)$
% by mass = (mass of solute)×100 / (mass of solution)		% by volume = (vol. of solute)×100 / (vol. of solution)
molarity (M) = (mol of solute) / (L of solution)		molality (m) = (mol of solute) / (kg of solvent)

32) A solution is made by dissolving 675 g of sulfuric acid (H_2SO_4) in 1000.0 g of water. Find the mole fraction of H_2SO_4 and water in the sulfuric acid solution.

0.110 H_2SO_4; 0.890 H_2O

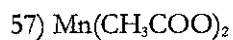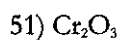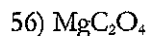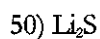33) 1.89 g of a gas dissolves in 2.30 L of water at a pressure of 1.75 atm. At what pressure will 2.00 g of the gas dissolve in 3.00 L of water if the temperature remains constant?

1.42 atm

34) What mass of lithium sulfate (Li_2SO_4) would you use to prepare 125 mL of a 2.50M solution of lithium sulfate?

34.3 g

35) What is the percent by mass of 103.9 g of sucrose ($C_{12}H_{22}O_{11}$) dissolved in 500.0 g of water?

17.20%

36) If 56.0 mL of methanol (CH_3OH) is dissolved in 105 mL of water, determine the percent by volume of methanol in the solution.

34.8%

37) A 45.0 mL sample of 12M hydrochloric acid (HCl) is diluted to a volume of 2500.0 mL. What is the molarity of the diluted solution?

0.22M

38) What is the molarity of a solution that contains 275.3 g of sodium chloride (NaCl) dissolved in 800.0 mL of solution?

5.889M

39) Calculate the molality of a solution that contains 234 g naphthalene ($C_{10}H_8$) dissolved in 2.98 mol carbon tetrachloride (CCl_4).

4.00m

40) An aqueous solution of methanol is 65.0% methanol by volume. (a) Find the volume of methanol and (b) the volume of water in a 350.0 mL sample of the solution.

228 mL; 122 mL

41) A 1.05 L sample of a 3.48M solution of hydrogen bromide (HBr) contains what mass of hydrogen bromide?

295 g

42) How would you correctly prepare 125 mL of a 1.50M solution of copper(II) sulfate ($CuSO_4$) from a 6.00M solution of $CuSO_4$?

31.2 mL

43) A 650.0 g sample of aqueous hydrogen peroxide (H_2O_2) contains 43.90% H_2O_2 by mass. What is the mass of the hydrogen peroxide in the solution?

285.4 g

44) The solubility of a gas is 1.83 g/L at STP. What is its solubility at a pressure of 1.4 atm and the same temperature?

2.6 g/L

45) A mass of 109 g of potassium iodide (KI) is dissolved in 587 g of water. What is the molality of the solution?

1.12m

46) A necklace contains 5.12 g of gold, 1.57 g of silver, and 2.05 g of copper. What is the mole fraction of each metal?

0.357 Au; 0.201 Ag; 0.442 Cu

I. Write the names of the following ionic compounds.

50) Li_2S 56) MgC_2O_4

51) Cr_2O_3 57) $Mn(CH_3COO)_2$

52) $Co(NO_2)_3$ 58) $Zn(CN)_2$

53) $Cd(MnO_4)_2$ 59) $Ni_2(SO_3)_3$

54) $Sn_3(PO_4)_2$ 60) Ag_2O_2

55) SrI_2 61) $BaCrO_4$
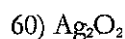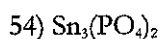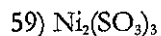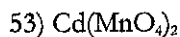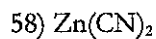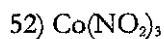
II. Write the formulas of the following ionic compounds.

62) lithium hydride   68) iron (III) dichromate

63) hydrogen sulfite   69) lead (IV) peroxide

64) chromium (III) carbonate   70) ammonium hypochlorite

65) ammonium hypochlorite   71) tin (IV) sulfide

66) chromium (VI) phosphate   72) cadmium nitrate

67) sodium nitrate   73) barium permanganate

III. Write the names of the following covalent molecules.

74) H_2CO_3 77) SiH_4

75) N_2Br_4 78) H_2S

76) $HClO_2$ 79) S_3F_6
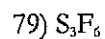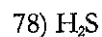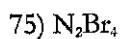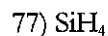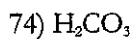
IV. Write the formula of the following covalent molecules.

80) carbon tetrabromide   83) phosphoric acid

81) dichlorine heptasulfide

84) phosphorus trichloride

82) hydrofluoric acid

85) sulfuric acid

V. Draw the structural formula of the following covalent compounds. Then give the molecule's shape and bond angle. If the molecule has resonance, show all configurations of that molecule.

86) PH_3

87) CBr_4

88) OCl_2

90) CO_2

VI. Balance the following chemical equations.

91) ____Al + ____O_2 → ____Al_2O_3

92) ____Fe + ____H_2O → ____H_2 + ____Fe_2O_3

93) ____$NaOH$ + ____$CaBr_2$ → ____$Ca(OH)_2$ + ____$NaBr$

94) ____$MgCl_2$ + ____NH_4NO_3 → ____$Mg(NO_3)_2$ + ____NH_4Cl

95) ____K_3PO_4 + ____$MgCl_2$ → ____$Mg_3(PO_4)_2$ + ____KCl

96) ____$Bi_2(SO_4)_3$ + ____NH_4OH → ____$Bi(OH)_3$ + ____$(NH_4)_2SO_4$

VII. Write a balanced equation for each of the following reactions, substituting symbols and formulas for names. Include the state of each reactant and product. Then identify the reaction type for each. If more than one reaction type applies, list all that apply.

97) When carbon is burned in air, carbon dioxide gas is formed.

98) Water and dinitrogen pentoxide gas react to produce aqueous hydrogen nitrate.

99) Heating solid ammonium nitrate causes it to break down into dinitrogen monoxide gas and water vapor.

100) Solid lithium reacts with water to produce aqueous lithium hydroxide and hydrogen gas.

101) In solution, calcium hydroxide and hydrochloric acid react to form calcium chloride and water.

102) Aqueous barium chloride and aqueous potassium carbonate react to produce solid barium carbonate and aqueous potassium chloride.

Name_____

1. Name the body systems and give the function of each.

2. List the orientation and directional terms and describe each.

3. Give the levels of structural organization from simplest to most complex.

4. Write the five body cavities and tell where each is located.

5. Distinguish between *atomic number* and *atomic mass*.

6. List the three subatomic particles, giving the charge and location of each.

7. Ninety-six percent of the human body is composed of which four elements?

8. What is the most abundant element in the human body?

9. What is an *isotope?*

10. Give the DNA nucleotide bases and tell which are complementary.

11. Distinguish between a *molecule* and a *compound.*

12. List three types of chemical reaction and give an example of each.

13. List the major organelles and describe each.

14. Differentiate between active and passive transport.

15. Define *diffusion* and describe the three types of diffusion.

16. Describe the two types of bulk transport.

17. List the four types of body tissues.

18. Explain the ways in which epithelium are classified.

19. List the types of connective tissue.

20. What is the superficial epidermis made of?

21. Describe the location of *mucous membranes* and *serous membranes.*

22. Describe the *epidermis, dermis,* and *hypodermis.*

23. Put the layers of the epidermis in order from superficial to deep.

24. What is the function of the "Rule of Nines."

25. What is the "ABCD" rule? What does it stand for?

26. Describe the two divisions of the skeletal system.

27. What are the four classifications of bones based on shape? Give examples.

28. What is the *periosteum*? What holds it onto the underlying bone?

29. Distinguish between a *simple* and *compound* fracture.

30. List the stages of healing a bone fracture.

31. List the five regions of the vertebral column from superior to inferior, telling how many vertebrae are in each.

32. List the three types of ribs from superior to inferior, telling how many of each type there are.

33. What is the function of red and yellow bone marrow?

34. Describe the three basic muscles types, including (a) location, (b) number of nuclei, (c) striations, and (d) control.

35. Describe the three types of connective tissue wrappings of skeletal muscles.

36. Give the functions of skeletal muscles.

37. What is the neurotransmitter for skeletal muscle?

38. Describe the types of filaments found in a sarcomere.

39. Differentiate between *isotonic* and *isometric* contractions.

40. Describe the fourteen types of body movements.

41. Name the parts of the CNS and the PNS.

42. Define the *afferent* and *efferent* divisions of the PNS.

43. Define *neuron* and give the major regions of a neuron.

44. List the four regions of the brain.

45. List five substances that can cross the blood-brain barrier.

46. Define *concussion, contusion,* and *cerebral edema.*

47. Give the neurotransmitters used by the somatic and autonomic nervous systems.

48. List the seven major glands of the endocrine system and describe the location and function of each.

Name_____

1. What is the function of the cardiovascular system?

2. Give the three layers of the heart wall.

3. List the four chambers of the heart.

4. List the four valves of the heart and tell where each is found in the heart.

5. Trace the path of blood through the body starting with the right atrium.

6. Define *pulse, blood pressure, systolic,* and *diastolic*.

7. Define *hypotension* and *hypertension*.

8. Define *lymph* and tell what materials are returned to the blood through lymph.

9. What harmful materials can enter lymph vessels?

10. Give the name and location of the areas where lymph nodes are most dense in the body.

11. Name the other four major lymphoid organs and give their function.

12. Define *allergies*.

13. Describe the general structure of antibodies.

14. Describe the four ways in which antibodies inactivate antigens.

15. Give the function of B-cells and the three types of T-cells.

16. List the six major organs of the respiratory system.

17. Give the proper name for the *throat, voice box,* and *windpipe*.

18. How many lobes is each lung divided into?

19. Explain the difference in the exchange of gases between internal and external respiration.

20. Compare and contrast the two phases of pulmonary ventilation.

21. Describe the physical and chemical factors that affect respiratory rate and depth.

22. List the seven organs of the alimentary canal.

23. Give the subdivisions of the small intestine.

24. Give the four structures that make up the colon.

25. List the five accessory digestive organs and give the function of each.

26. Define *peristalsis* and *segmentation* and tell which organs use each.

27. Give the functions of the urinary system.

28. List the organs of the urinary system and give the function of each.

29. Give the structures that make up the kidneys.

30. Describe the structure and function of the nephron.

31. Describe the two types of nephrons.

32. Describe the process of urine formation.

33. Describe the structure and functions of the parts of the male reproductive system.

34. Explain the makeup of semen and give the advantages of the accessory gland secretions.

35. Describe the structure and functions of the parts of the female reproductive system.

36. Describe the stages of the menstrual cycle.

37. Describe the four stages of pregnancy and development.

1.

2. List the steps of the scientific method and define each.

3. List *Newton's Laws of Motion* and describe each.

4. Give the four basic forces of nature.

5. Define *gravity* and give the acceleration due to gravity on Earth.

6. Define *kinetic energy* and give the formula used to calculate it.

7. Define *potential energy* and give the formula used to calculate it.

8. Define thermal energy and give its metric unit of measure.

9. Describe the *Law of Conservation of Energy*.

10. Define *work* and give the formula used to calculate it.

11. Define *power* and give the formula used to calculate it.

12. Define *simple machine*.

13. Define *compound machine*.

14. List the six types of simple machines and describe each.

15. Define *temperature*.

16. Describe the three ways thermal energy is transferred.

17. Define *conductor* and *insulator*.

18. Describe an *internal combustion engine*.

19. Define *static electricity*.

20. Define *circuit* and describe the two types of circuits.

21. Define *Ohm's Law* and give its formula.

22. Define *resistance* and give its metric unit of measure.

23. Define *magnet* and *magnetic poles*.

24. Define *alternating current* and *direct current*.

25. Define *transformer* and describe the two types of transformers.

26. List the three types of radiation, including descriptions of the particle emitted and penetrating power of each.

SUN, EARTH, MOON
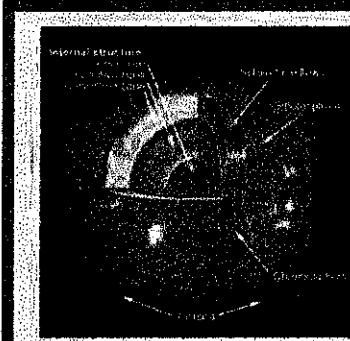
• It is a source of heat and light for our world. • It is a star (burning gas). • It is a million times bigger than the Earth • It rotates on an axis • Temperature is 5600 • Sphere	• 4 times larger than the moon • Only planet which has life. • 3rd in line of planets from the sun. • 24 hours to rotate on an axis once • Sphere	• Rock • Cratered surface • It takes 29 days to revolve around the Earth • Sphere

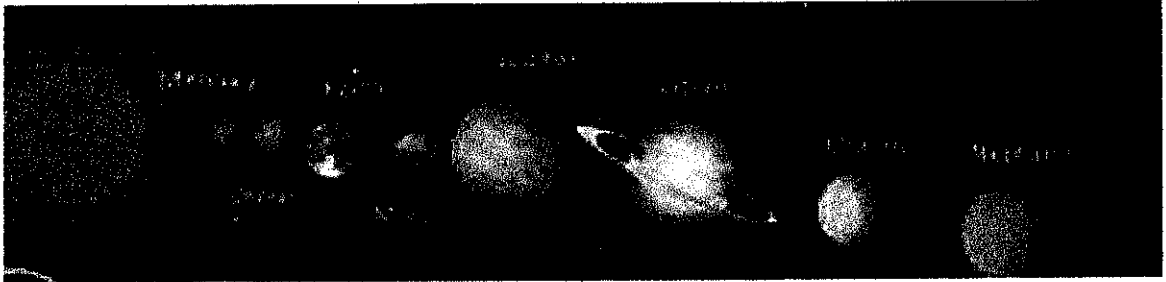# EARTH'S ROTATION & AXIS

- **Rotation→** spinning motion
- Earth revolves around the sun
- **Rotation axis→** line on which an object rotates on an imaginary line through its center (axis)
- **Tilt of Earth's Rotation Axis→** Earth's rotation axis is tilted

North Pole

South Pole
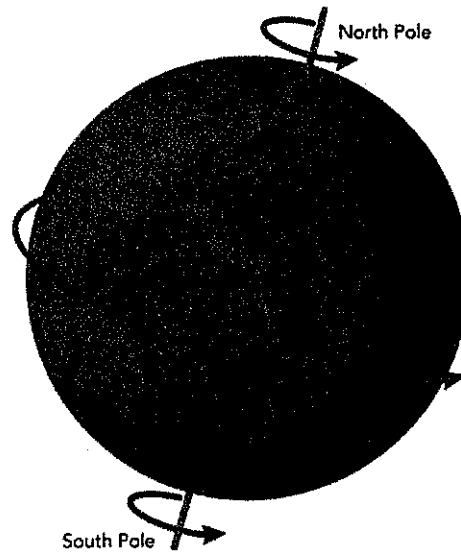
PLANETS

My→ Mercury
Very→ Venus
Eager→ Earth
Mother→ Mars
Just→ Jupiter
Served→ Saturn
Us→ Uranus
Nine→ Neptune
Pizzas—but then she took them away! → Pluto used to be a planet, but lost it's status ☹

EARTH-SUN-MOON SYSTEM

- **The Sun→** nearest star to Earth
- **Earth's Orbit→** Earth move around the Sun in a nearly circular path
- **Revolution→** motion of one object around another object
- **Sun's Gravitational Pull→** the Earth orbits the sun due to the law of gravitational mass = greater gravitational pull
- Closer distance = greater gravitational pull
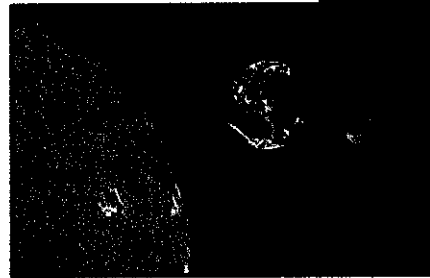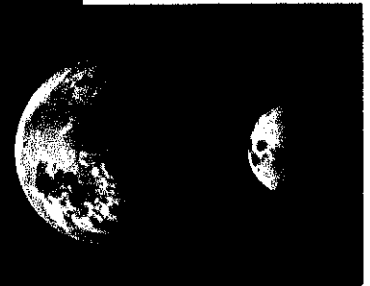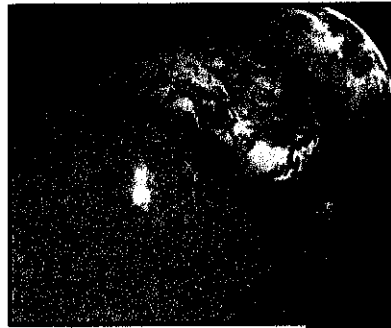
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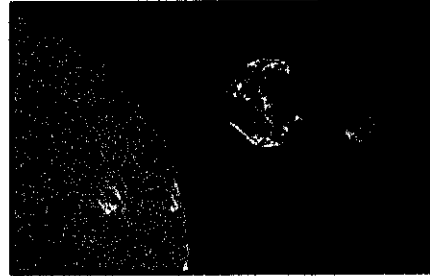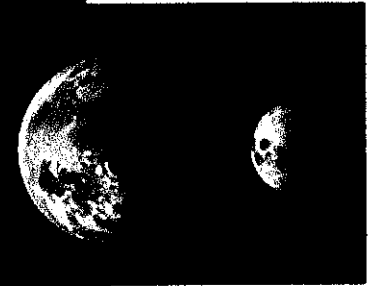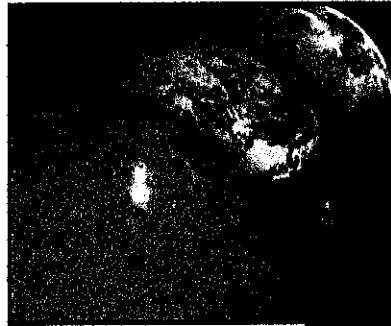
THE SOLAR SYSTEM

Objects That Orbit the Sun

SEQUENCE OF THE PLANETS

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

- M, V, E, M, J, S, U, N
- Inner and Outer Planets
- Dwarf Planets
- Asteroids
- Comets
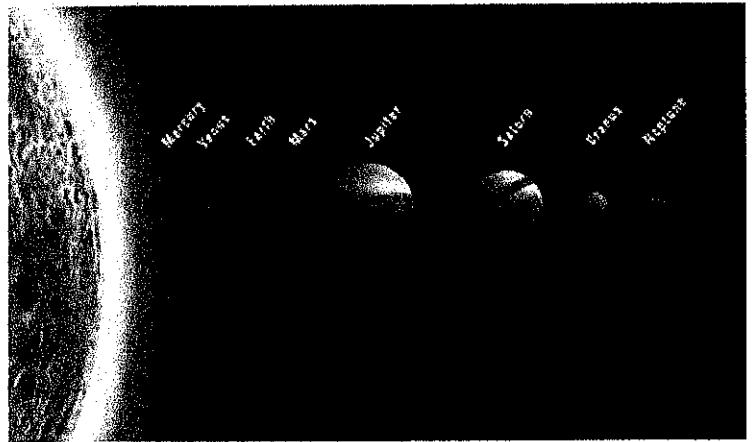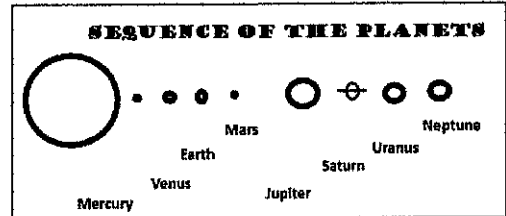
PLANETS AND SOLAR SYSTEM

		Properties of Planets					
	Orbit	Size	Composition	Density	Rotation	Revolution	Atmosphere
Mercury							
Venus							
Earth							
Mars							
Jupiter							
Saturn							
Uranus							
Neptune							
Planet Formally Known as Pluto							

TILT & SEASON

When northern hemisphere is tilted toward the Sun→ more daylight hours, warmer temperatures, but southern hemisphere gets fewer daylight hours and cooler temperatures because it is hidden from the sun

Autumn in the Southern Hemisphere

Winter in the Southern Hemisphere

SUN (much bigger)

149 597 910 km

Summer in the Southern Hemisphere

Spring in the Southern Hemisphere
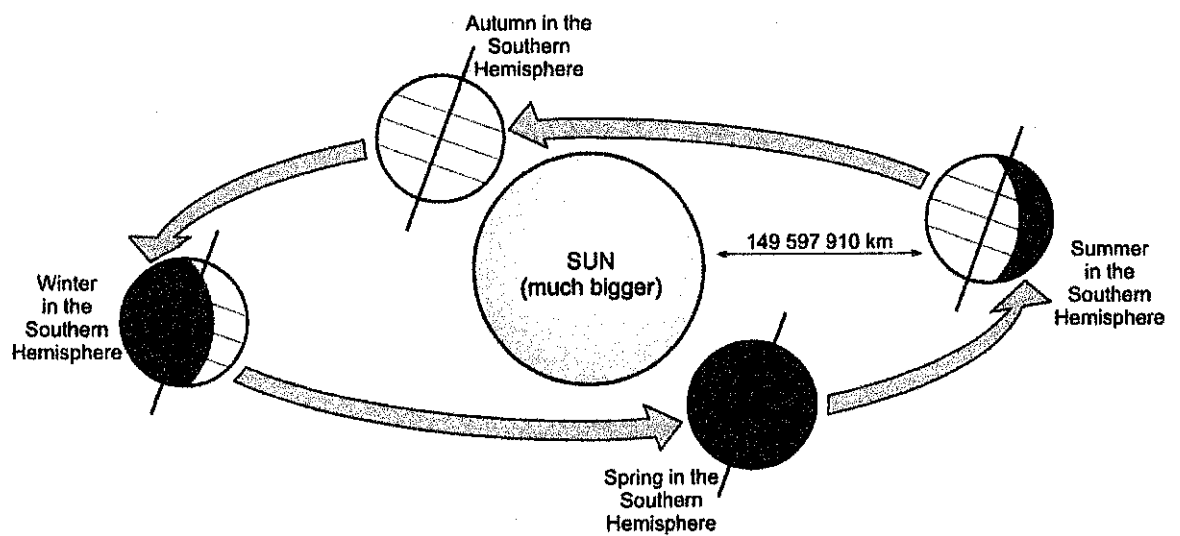
PLANETS

o **Inner Planets**→ terrestrial planets because surfaces are solid
  ▪ Mercury, Venus, Earth, & Mars
o **Outer Planets**→ further away, larger & made of mostly gas
o **Dwarf Planets**→ small, but orbits sun, and have spherical shape
  ▪ Ceres, Makemake, **Pluto**, Eris, Earth's Moon

SEQUENCE OF THE PLANETS

Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune
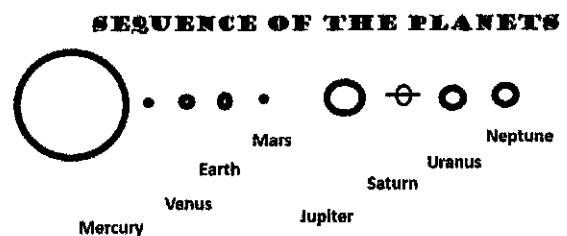
SUN AND OTHER STARS

- **Star→** large ball of gas held together by gravity with a core so hot that nuclear fusion occurs
- **Classifying Stars→** based on temperature, color, & mass
- Red is the coolest
- Blue-white is the hottest
- **Hertz sprung-Russell Diagram→** plots luminosity against temperature
  - Y-axis = increasing luminosity
  - X-axis = decreasing temperature

Characteristics of Stars

Blue Giants

Red Supergiants

Absolute Magnitude (increasing)

Main Sequence

Red Giants

White Dwarfs

Main Sequence

Temperature (decreasing)

RS **STAAR Reporting Category 5–**
INTERDEPENDENCE within ENVIRONMENTAL SYSTEMS

B.11. The student knows that biological systems work to achieve and maintain balance.
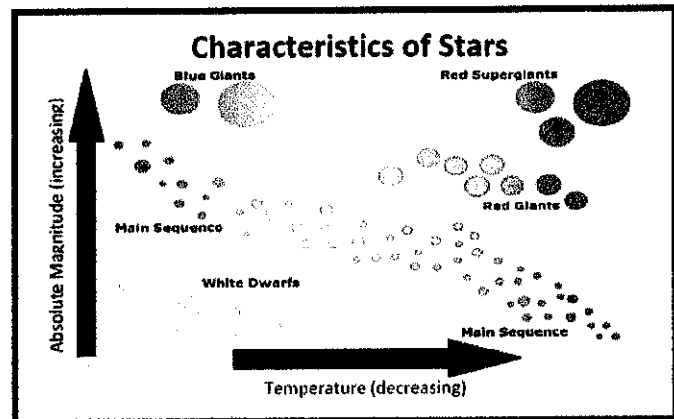
B.11 (B) Describe how event and processes that occur during ecological succession can change populations and species diversity.

I. Ecological Succession

1. Ecological _____ is the natural progression of _____ replacement over time.

Two Types of Ecological Succession		
Type of Succession	**Description**	**Example**
2. _____ succession	3. Pioneer species such as fungus and bacteria begin breaking down rock to create _____.	4.
5. _____ succession	6. _____ that followed the disruption of an established ecosystem.	7.

8. Is ecological succession best described as a progression of small changes, or one large change? Explain. _____

_____

_____.

9. Surtsey is an island located south of Iceland that was formed by a volcanic eruption. Surtsey first appeared in the 1960s. Ecologists documented the stages of succession as found below:

A. Dwarf willow trees begin to grow on the island.
B. Mosses, lichens, and plants that are adapted to be dispersed by the wind or sea and able to grow in the sand appear on the island.
C. Vascular plants included sea lyme grass and oyster plants appear.
D. The lava and sand formation that resulted from the eruption are barren with few nutrients.

Write the correct order of the letters A-D above to best represent the order of succession: _____

10. This is an example of (underline one) [primary I secondary] succession.

II. Ecological Succession – Changes in Populations and Species Diversity.

True or False- for each term below, determine if it is true or false by writing a "T" for true or an "F" for false. If false, cross out a part of the phrase and rewrite it to make it true.

11. _____ The longer an ecosystem has been established, the greater the species diversity.

12. _____ A newly formed volcanic island will have greater species diversity than an established rainforest.

13. _____ Species diversity can increase or decrease in response to environmental changes.

II. Ecological Succession – Changes in Populations and Species Diversity- continued

Species Diversity Over Time
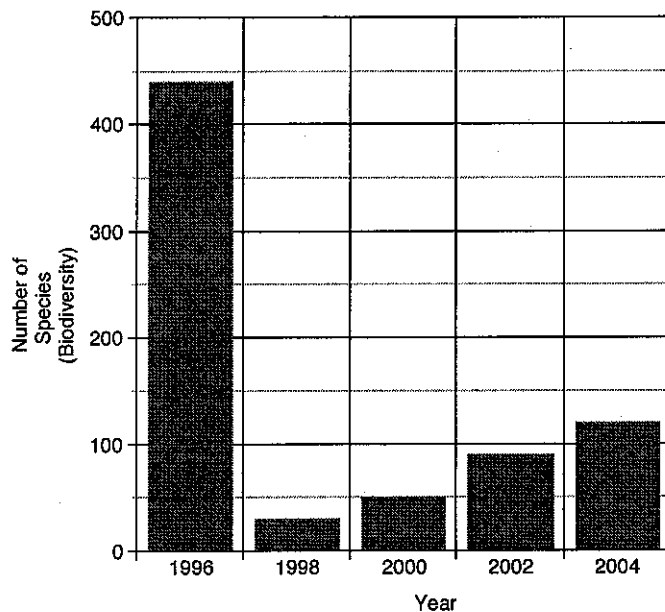
A decrease in species diversity is directly related to a change in the ecosystem. The change could be traumatic or slight. The more traumatic the event, the more traumatic the change in biodiversity.

14. Given this correlation, would you argue that this graph best represents the change in species diversity due to a major or minor event? Explain:

_____

_____

_____.

15. Come up with an example of an event that may be responsible for the change of species diversity represented in this graph: _____

_____.

16. In ecological succession, what would most likely come first when forming an established ecosystem- large herbivores or higher order carnivores? Explain your answer:

_____

_____.

17. _____ As an ecosystem progresses, the soil depth increases. This is most likely because:
a. Pioneer species such as lichens and mosses continue to break down rocks.
b. The ecosystem tries to attract more species by supplying more soil.
c. The humus formed from fallen leaves and dead plants and animals is decomposed into rich soil, the layers increasing with time.
d. The water absorbed from rainfall heightens the soil.

18. How might the increases in soil depth and nutrients affect the population of plants?

_____

_____.

(RS) **STAAR Reporting Category 5—**
INTERDEPENDENCE within ENVIRONMENTAL SYSTEMS

B.12. The student knows that interdependence and interactions occur within an environmental system.

B.12 (A) Interpret relationships, including predation, parasitism, commensalism, mutualism, and competition among organisms.
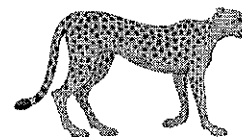
1. Define symbiosis: _____

_____.

Type of relationship	Description
2. Predation	
3. Parasitism	
4. Commensalism	
5. Mutualism	
6. Competition	

For each scenario described below, determine if it as example of the following:
a) Predation; b) Parasitism c) Commensalism; d) Mutualism or e) Competition
   Each letter can be used more than once or not at all.

7. _____ Bees collect nectar from flowers to make honey; in doing so, pollen sticks to the bees. As the bees travel from flower to flower, they help to pollinate the flowers.

8. _____ Over a long period of time, flower shapes and color variation have changed as a direct response to attract more pollinators, such as bees and hummingbirds.

9. _____ Mistletoe contains root-like structures that penetrate the branches of oak trees, where they absorb water and minerals from the oak tree.

10. _____ Acacia ants live in the thorns of the bullshorn acacia plant and help to protect the plant by attacking insects and animals that come near the plant to try to feed on it.

11. _____ Some plants, such as burdocks, form seedpods that contain sticky burs on them. As animals pass through the plants, the seeds to stick to their fur and are dropped at different locations.

12. _____ Lions and cheetahs prey upon the same food source in the savanna.

(RS) STAAR Reporting Category 5-
INTERDEPENDENCE within ENVIRONMENTAL SYSTEMS

B.12. The student knows that interdependence and interactions occur within an environmental system.

B.12 (A) Interpret relationships, including predation, parasitism, commensalism, mutualism, and competition among organisms.

In the 1930s, cane toads (*Bufo marinus*) were introduced to the sugarcane crops of Queensland, Australia. Cane toads are native to South America, and were never present in or indigenous to any parts of Australia before they were brought to Queensland by man. The intent was that the cane toads would eat the sugarcane beetle, which were destroying the crops, as a means to avoid pesticides.

Cane toads have poison glands that produce a highly toxic substance. Domesticated animals, such as dogs, were put at risk if they approached the toad. If the cane toad was successfully eaten by Australian wildlife or domesticated pets, the predator would die. Kookaburra birds, which typically eat snakes and lizards, were dying at higher rates from eating the toads.

Because the cane toads have no natural predators, they were able to grow in numbers and expand their territory. The cane toads ate a lot of the Australian wildlife, but never showed much interest in the sugarcane beetles nor had an impact on improving the crops.

13. Provide evidence as to why the cane toad is an invasive species in Australia:

_____

_____.

14. What was the cause of the cane toads being able to proliferate quickly and increase their population size? _____

_____.

15. Why were the cane toads brought to Australia from South America? _____

_____

_____.

SS

STAAR Reporting Category 5–
INTERDEPENDENCE within ENVIRONMENTAL SYSTEMS

B.12. The student knows that interdependence and interactions occur within an environmental system.

B.12 (B) Compare variations and adaptations of organisms in different ecosystems
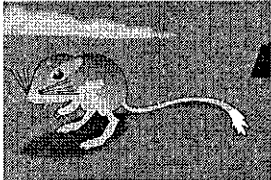
Read about the 3 different squirrel species in the table below, then determine which species belongs to each biome for numbers 1-3. Write your reasoning, or how you think each species is adapted to its specific environment, for numbers 4-6.

Species	Physical Adaptations	Behavioral Adaptations
Antelope squirrel	Active late at night and early in the morning; can lower their body temps to survive hot environments.	Become less active when food is scarce to preserve energy.
Barbary squirrel	Active mostly during the night or early mornings; their bushy tails blend into the environment.	Typically build their burrows or nests near a water source and stay nearby to avoid predators.
Douglas squirrel	Active during the day; have sharp claws for climbing	Collect nuts mid-to-late summer to prepare for winter hibernation.

Species	Biome	How its adapted to its environment
1.	**Desert**	4.
2.	**Grasslands**	5.
3.	**Temperate Forest**	6.

7. Red foxes can be found in temperate rain forests, taigas, and grasslands. Their fur is usually a combination of pale yellows, reds, grays, and browns. Arctic foxes found in the tundra have white fur. Describe how this variation among the fox family is an adaptation for their particular environment:
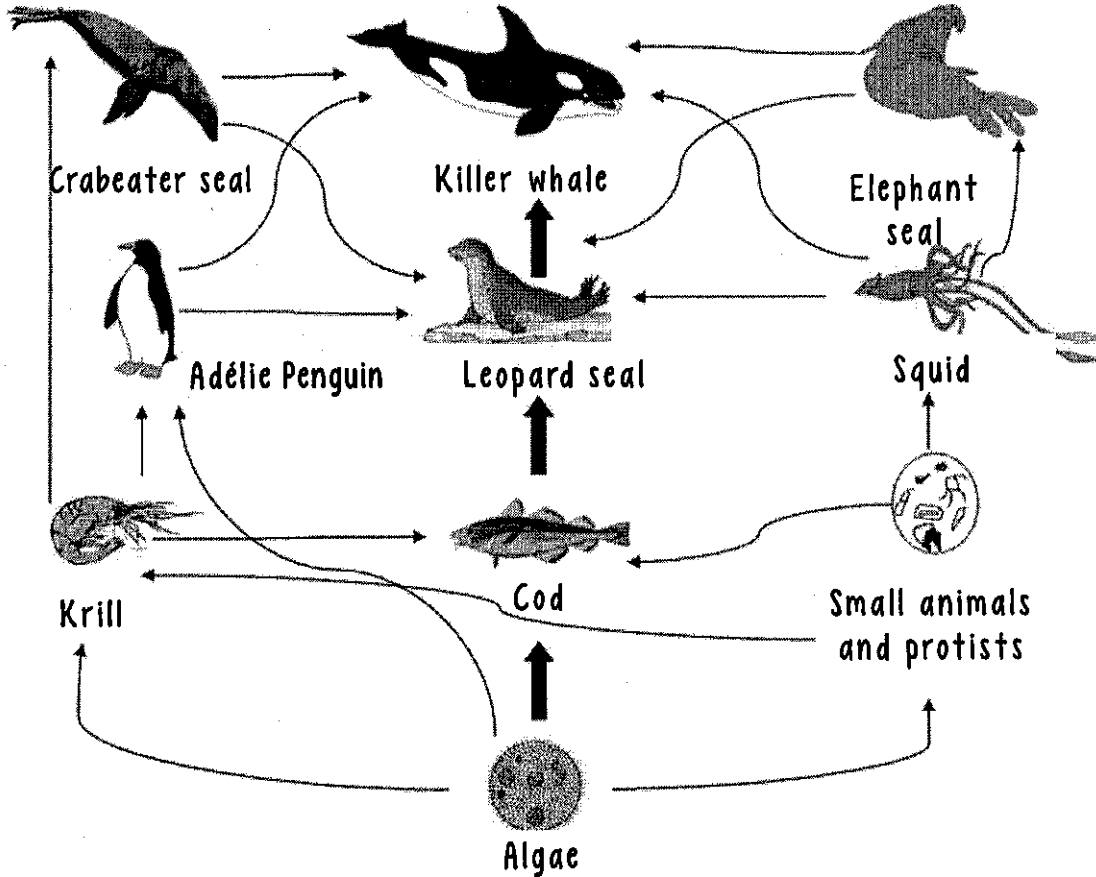
_____

_____

Kangaroo Rat	Prey Adaptation	Physical Adaptation
	The kangaroo rat has powerful hind legs that it uses for burrowing or to leap distances of 9 feet to escape predators such as rattlesnakes and owls.	Kangaroo rats do not need to drink water; they are able to get all the water they need from the seeds that they eat.

8. How is the kangaroo rat specifically adapted to the desert? _____

_____

(RS) **STAAR Reporting Category 5–**
INTERDEPENDENCE within ENVIRONMENTAL SYSTEMS

B.12. The student knows that interdependence and interactions occur within an environmental system.

B.12 (C) Analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids.

1. A food web is an interconnected map of multiple _____ _____.

Crabeater seal   Killer whale   Elephant seal

Adélie Penguin   Leopard seal   Squid

Krill   Cod   Small animals and protists

Algae

2. The marine food web above contains 8 food chains. Examine the food web and find one food chain where the krill is the secondary consumer AND the killer whale is the fifth (quinary) consumer. Write the food chain in the space below using arrows:

• _____

3. In your food chain above, what is the tertiary consumer? _____

4. The arrows depicted in food chains or food webs represent the flow of _____ between organisms.

5. Name one important factor missing from this food web and the role they play in ecosystems:

_____

_____

Cause	Population	Effect on Population
A significant oil spill has caused a layer of oil to sit on the ocean's surface, blocking sunlight from the organisms below.	Krill	6.
	Crabeater seals	7.
	Killer whales	8.

Trophic Level	Type of Organism	Example
FIRST	Producer	Sunflower seeds
SECOND	9.	Mouse
THIRD	10.	Frog
FOURTH	11.	Weasel
FIFTH	Quaternary Consumer	Hawk

12. In the space below, construct a food chain using the chart to guide you:

```
[        ] → [        ] → [        ] → [        ] → [        ]
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13. Notice that there are 100,000 kcal (energy) found within the producers in the ecosystem represented by the model at left. For the remaining trophic levels, write how many kcal (energy) you can expect to find.
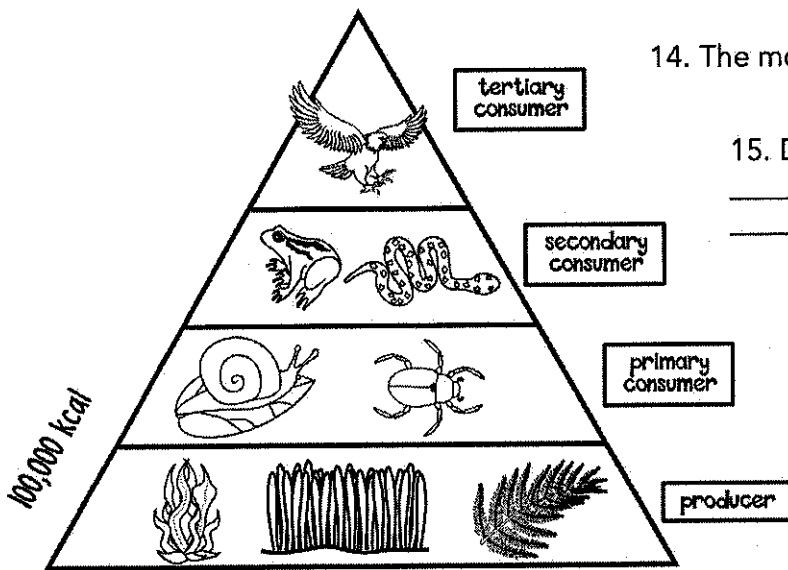
14. The model at left depicts a(n) _____ _____.

15. Describe the ten percent law: _____
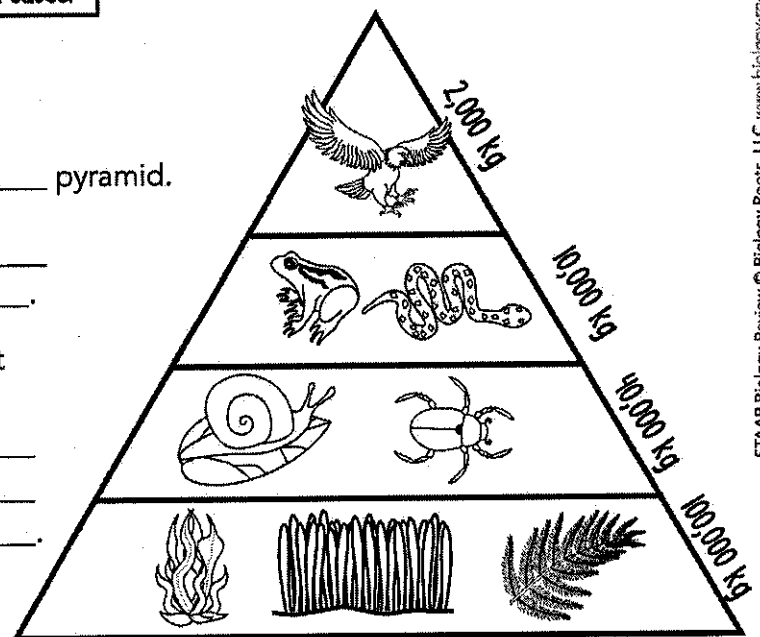_____
_____.

16. Much of the energy available in the trophic levels is lost as _____.

17. The model at right represents a _____ pyramid.

18. Define biomass: _____
_____.

19. Why do the producers typically hold the most biomass in a sustainable ecosystem?
_____
_____
_____

20. Describe the relationship among food chains and ecological pyramids:

_____
_____
_____.

Greater Horseshoe Bat

The Greater Horseshoe Bat is one of the larger bat species, and is the rarest of the fourteen species found in the southern part of England and southwest Wales. Studies have shown that are only 4,000-6,000 Greater Horseshoe Bats left in existence. The species has been declared as endangered in Europe.
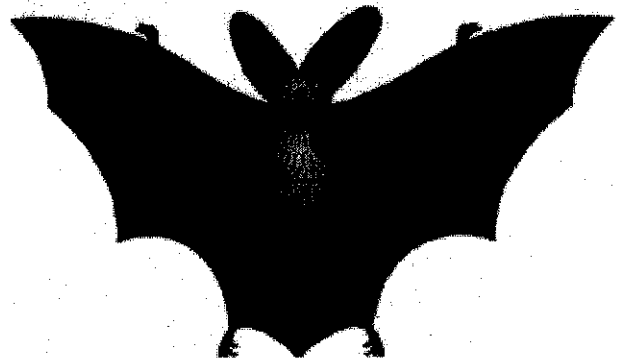
Greater Horseshoe Bats prefer to roost in the attics of old buildings, tunnels, mines, caves or hollow trees. Destruction of these habitats, especially those populated by breeding females, has lead to a decline in the number of these bats. Another risk to the bat population is insecticides used on crops. The poisons leave the bats without their main food source, insects.

People are just beginning to realize how fascinating Greater Horseshoe Bats are. A great deal of research has been done to educate the public about the roosts, flight patterns, diets, and habitats of these bats. As people learn more, they are realizing that bats are not sinister, but interesting and worth saving.

Efforts to support the population of the Greater Horseshoe Bats include limiting insecticide use, maintaining land in a way that is beneficial to bats (keeping pastures, woodlands, and hedgerows), and continuing to inform the public as to the needs of the bats in agricultural settings.

Greater Horseshoe Bat - Multiple Choice Questions

Circle the correct answer.

1. The Greater Horseshoe Bat is one of ____ species in England and Wales?

    a. 10
    b. 12
    c. 14
    d. 16

2. Greater Horseshoe Bats prefer to roost in

    a. tunnels
   b. mines
    c. old buildings
    d. all of the above

3. Insecticides are a risk to Greater Horseshoe Bat populations because

    a. insecticides get rid of insects which are their food source
    b. the chemicals are poisonous to the bats
    c. they kill plant life, which is what the bats eat
    d. they are not a risk factor

4. Research has not been done on _____ of the Greater Horseshoe Bat.

    a. flight patterns
    b. diet
    c. habitats
    d. fear

5. Keeping pastures and woodlands helps the bats by

    a. this does not help the bats
    b. giving them places to live
    c. maintaining attractive scenery
    d. providing leaves for food

6. Some people think bats are sinister. The word sinister means

    a. numerous
    b. tidy
    c. ominous
    d. loud

Siberian Tiger
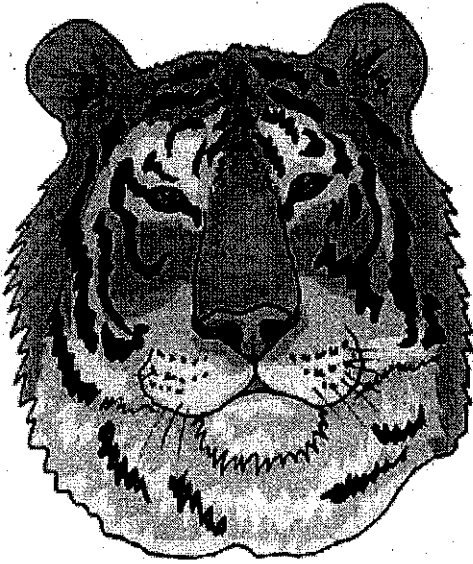
Only 300 – 400 Siberian Tigers remain in the wilds of eastern Russia. The largest of all cats, these tigers are well known for their strength. Destruction of forest habitats and hunting have reduced the population of all types of tigers, and despite protection programs, poaching is still a significant threat.

Traditional Chinese Medicine holds the belief that tiger bones, whiskers and other body parts are vital in curing diseases. Poachers are paid highly for hunting tigers for this purpose.

Siberian Tigers are carnivorous, mostly hunting for deer, wild pig, and fish. They need to eat more than 20 pounds of meat per day to live in their cold climate. These amazing cats are able to eat over 100 pounds of meat at one meal. The largest Siberian Tiger was noted to be nearly 850 pounds.

One of the efforts to preserve and increase the population of Siberian Tigers is a program to breed them in captivity as a part of the Species Survival Plan® (SSP). The SSP breeds endangered species to maintain diversity and improve their hopes for survival of the species. There are 500-700 Siberian Tigers alive in zoos around the world.

If this species dies out, the world will lose this beautiful family of the largest tigers in the world. Deforestation, poaching, and hunting must be curtailed to save the Siberian Tigers.

Siberian Tiger - Short Answer Questions

1. Write a short story from the Siberian Tiger's point of view that describes the threats to his species.

2. Below is a picture of a Siberian Tiger. Describe him using at least 6 adjectives.

3. Research how a Siberian Tiger hunts. Describe its methods.

4. Describe the adaptations of the Siberian Tiger.

5. Write a brief persuasive essay about reducing poaching of Siberian Tigers.

6. Visit WCS Russia

   (http://www.wcsrussia.org/Projects/SiberianTigerProject/tabid/1222/language/en-US/Default.aspx)

   to read about the World Conservation Society and the Siberian Tiger Project. Summarize the efforts for managing conflicts   between the tigers and humans.

7. Also on the website, locate the graph that indicates total mortality related to poaching. What percentage of tiger deaths are related to poaching? To suspected poaching?