Environmental Systems

Assignment for week of March 23-27th

1. Please read Chapter 10, section one entitled 'What is Biodiversity?'
2. Once you have completed the reading, take the quiz.
3. Once your work is complete, please take a picture and email to your teacher.

If you have any questions regarding the assignment please feel free to contact your teacher for this subject. Emails are listed below:

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Name_____ Class _____ Date _____

Assessment

Quiz

Section 1: What Is Biodiversity?

MATCHING

Write the letter of the term or phrase that best matches the description.

_____ 1. species that are critical to the functioning of an ecosystem

_____ 2. all the different genes contained in all members of a population

_____ 3. tourist experiences among unique wildlife and ecosystems

_____ 4. varieties developed by combining genetic material from other populations

_____ 5. the number and variety of different species in a given area

a. hybrids
b. ecotourism
c. biodiversity
d. genetic diversity
e. keystone species

MULTIPLE CHOICE

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

_____ 6. Hunting sea otters along the U.S. Pacific coast resulted in
a. an increase in biodiversity.
b. the extinction of kelp.
c. a decrease in biodiversity.
d. a reduction in the sea urchin population.

_____ 7. To which groups do most of the unknown species belong?
a. mammals and trees
b. insects and fungi
c. bacteria and plants
d. protozoans and algae

_____ 8. A crop that results from combining genetic materials is called
a. a hybrid variety.
b. a keystone species.
c. a bottleneck offspring.
d. a wildflower species.

_____ 9. Which level of biodiversity may still be reduced after a species recovers from a threat to its survival?
a. ecosystem diversity
b. genetic diversity
c. population diversity
d. species diversity

_____ 10. How do people benefit from biodiversity?
a. aesthetic or personal enjoyment
b. variety of food sources
c. source of new products
d. all of the above

What Is Biodiversity?

Every day, somewhere on Earth, several unique species of organisms become *extinct* as the last members of the species die—often because of human actions. Scientists are not sure how many species are becoming extinct or even how many species there are on Earth. How much extinction is natural? Can we—or should we—prevent extinctions? The study of biodiversity helps us think about these questions, but does not give us all the answers.

SECTION 1

Objectives

- Describe the diversity of species on Earth, and relate the difference between known numbers and estimated numbers of species.
- List and describe three levels of biodiversity.
- Explain four ways in which biodiversity is important to ecosystems and humans.
- Analyze the potential value of a single species.

Key Terms
biodiversity
gene
keystone species
ecotourism

A World Rich in Biodiversity

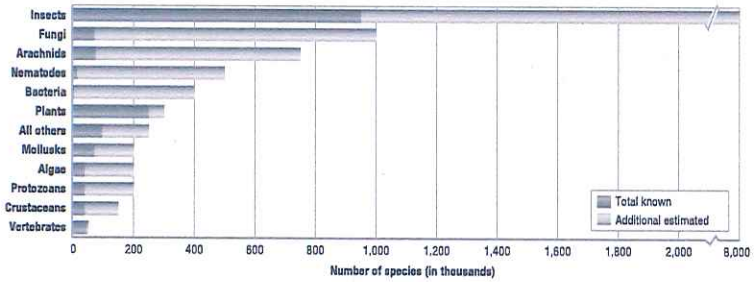
The term **biodiversity**, which is short for "biological diversity," usually refers to the number of different species in a given area. Certain areas of the planet, such as tropical rain forests, contain an extraordinary variety of species. The complex relationships between so many species are hard to study, but humans may need to understand and preserve biodiversity for our own survival.

Unknown Diversity

The study of biodiversity starts with the unfinished task of cataloging all the species that exist on Earth. As shown in **Figure 1.1**, the number of species known to science is about 1.9 million, most of which are insects. However, the actual number of species on Earth is unknown. Scientists agree that we have not studied Earth's species adequately. Recently, it was estimated that there are around 9 million species of eukaryotes, which includes protists, animals, and plants. New species are considered *known* when they are collected and described scientifically. Unknown species may exist in remote wildernesses, deep in the oceans, and even in cities.

FIGURE 1.1

Number of Species on Earth
About 1.9 million species on Earth are known to science. Many more species are *estimated* to exist, especially species of smaller organisms. Scientists continue to revise these estimates.



Source: World Conservation Monitoring Center.

Levels of Diversity

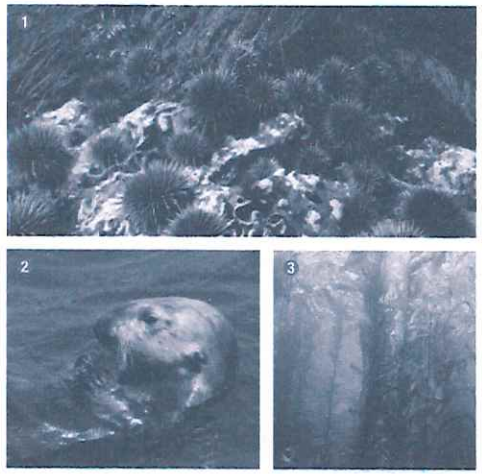
Biodiversity can be studied and described at three levels. *Species diversity* refers to the number of different species in an area. This kind of diversity has received the most attention and is most often what is meant by *biodiversity*. *Ecosystem diversity* refers to the variety of habitats, communities, and ecological processes within and between ecosystems. *Genetic diversity* refers to all the different *genes* contained within all members of a population. A **gene** is a piece of DNA that codes for a specific trait that can be inherited by an organism's offspring.

Benefits of Biodiversity

Biodiversity can affect the stability of ecosystems and the sustainability of populations. In addition, there are many ways that humans clearly use and benefit from the variety of life forms on Earth. Biodiversity may be more important than we realize.

FIGURE 1.2

Keystone Species The sea otters of North America are an example of a keystone species, upon which a whole ecosystem depends.



In the 1800s, sea otters were hunted for their fur. They disappeared from the Pacific coast of the U.S. ❶ Sea urchins, with no more predators, multiplied and ate the kelp. The kelp beds began to disappear from the area. ❷ In 1937, a small group of surviving otters was discovered. With protection and scientific efforts, the otter populations grew. ❸ The otters once again preyed on the sea urchins. The kelp beds regenerated.

Species Are Connected to Ecosystems

We depend on healthy ecosystems to ensure a healthy biosphere that has balanced cycles of energy and nutrients. Species are part of these cycles. Many species play important roles in ecosystems. Every species is probably either dependent on or depended upon by at least one other species in ways that are not always obvious. When one species disappears from an ecosystem, a strand in a food web is removed. How many threads can be pulled from the web before it collapses? We often do not know the answer until it is too late. In general, the more species there are, the more stable an ecosystem is.

But some species are so clearly critical to the functioning of an ecosystem that they are called **keystone species.** One example of a keystone species is the sea otter. **Figure 1.2** shows how the loss of sea otter populations led to the loss of the kelp beds along the Pacific coast of the United States and how the recovery of otter populations led to the recovery of the kelp populations.

Species and Population Survival

Genetic diversity within populations is important to species survival. If there is high genetic diversity, it is more likely that some individuals will be adapted to survive new diseases or environmental changes. When a population shrinks, its genetic diversity decreases as though it is passing through a bottleneck, as shown in **Figure 1.3**. Even if the population can increase again, its genetic diversity will be reduced, putting it at risk. Then, members of the population may become more likely to inherit genetic diseases.

Medical, Industrial, and Agricultural Uses

People throughout history have used the variety of organisms on Earth for food, clothing, shelter, and medicine. Of the top 150 prescription drugs used in the United States, 74 percent are derived from plants. Almost all antibiotics are derived from chemicals found in fungi. **Figure 1.4** lists some plants from which medicines are derived.

For some industries, undiscovered and poorly studied species represent a source of potential products. New chemicals and industrial materials may be developed from chemicals discovered in all kinds of species. The scientific community continues to find new uses for biological material and genetic diversity.

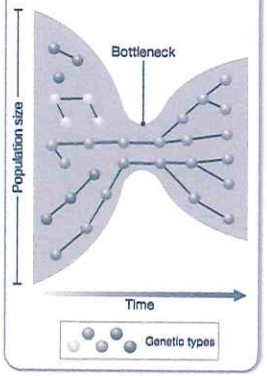
FIGURE 1.4

COMMON MEDICINES DERIVED FROM PLANTS

Medicine	Origin	Use
Neostigmine	calabar bean (Africa)	treatment of glaucoma and basis for synthetic insecticides
Turbocurarine	curare vine (South America)	surgical muscle relaxant; treatment of muscle disorders; and poison for arrow tips
Vincristine, vinblastine	rosy periwinkle (Madagascar)	treatment of pediatric leukemia and Hodgkin's disease
Bromelain	pineapple (South America)	treatment to control tissue inflammation
Taxol	Pacific yew (North America)	anticancer agent
Novacaine, cocaine	coca plant (South America)	local anesthetic and basis for many other anesthetics
Cortisone	wild yam (Central America)	hormone used in many drugs
L-dopa (levodopa)	velvet bean (tropical Asia)	treatment of Parkinson's disease
Reserpine	Indian snakeroot (Malaysia)	treatment to reduce high blood pressure

FIGURE 1.3

Bottleneck When a population is reduced to a few members, this creates a *bottleneck* of reduced genetic diversity. The genetic diversity of the population is greater before the bottleneck than after it.



CHECK FOR UNDERSTANDING

Explain Why is genetic diversity important for the survival of a species?

FIGURE 1.5

Crop Origins A produce market in Bolivia shows a diversity of native foods. Many crops that are grown in the United States originated elsewhere.

FOOD ORIGINS
North America, Central America, and South America
corn (maize), tomato, bean (pinto, green, and lima), peanut, potato, sweet potato, avocado, pumpkin, pineapple, cocoa, vanilla, and pepper (green, red, and chile)
Northeastern Africa, Central Asia, and Near East
wheat (several types), sesame, chickpea, fig, lentil, carrot, pea, okra, date, walnut, coffee, cow, goat, pig, and sheep
India, East Asia, and Pacific Islands
soybean, rice, banana, coconut, lemon, lime, orange, cucumber, eggplant, turnip, tea, black pepper, and chicken

Humans benefit from biodiversity every time they eat. Most of the crops produced around the world originated from a few areas of high biodiversity. Some examples of crop origins are shown in **Figure 1.5**. Most new crop varieties are *hybrids*, or crops developed by combining genetic material from more than one population. Depending on too few plant varieties for food is risky. For example, famines have resulted when an important crop was wiped out by disease. But some crops have been saved from diseases by being crossbred with wild plant relatives. In the future, new crop varieties may come from species not yet discovered.

Ethics, Aesthetics, and Recreation

Some people believe that we should preserve biodiversity for ethical reasons. They believe that species and ecosystems have a right to exist whether or not they have any other value. To people of some cultures and religions, each organism on Earth is a gift with a higher purpose.

People also value biodiversity for aesthetic or personal enjoyment—keeping pets, camping, photographing wildflowers, or watching wildlife. Some regions earn the majority of their income from **ecotourism**, which is a form of tourism that supports the conservation and sustainable development of ecologically unique areas.

Section 1 Formative Assessment

Reviewing Main Ideas

1. **Describe** the general diversity of species on Earth in terms of relative numbers and types of organisms. Compare known numbers of species to current estimates.
2. **Describe** three levels of biodiversity. Which level is most commonly meant by *biodiversity*?
3. **Explain** how biodiversity is important to ecosystems, and give examples of how it is important to humans.

Critical Thinking

4. **Analyzing a Viewpoint** Is it possible to put a price on a single species? Explain your answer.
5. **Predicting Consequences** What is your favorite type of organism? If this organism were to go extinct, how would you feel? What would you be willing to do to try to save it from extinction? Write a short essay describing your reaction.

Biology

Name_____ Biology Date_____

Period _____ Chapter 15 Evolution

Fill in the blanks for each of the questions below. You can use your notes or Google to find the answers.

1. The random effect that can occur when a small population settles in an area separated from the rest of the population and interbreeds, producing unique allelic variations is known as _____.

2. _____ is the change in the frequency of a trait based on competition for a mate.

3. _____ is Darwin's term for the selective breeding of organisms selected for certain traits in order to produce offspring having those traits.

4. The more-primitive characteristics that appeared in common ancestors is _____.

5. _____ occurs when a population divided by a geographic barrier evolves into two or more populations unable to interbreed.

6. Hereditary changes in groups of living organisms over time is known as _____.

7. _____ is the process in which a large population declines in number, then rebounds to increase the population again.

8. The process in which individuals with average traits are removed, creating two populations with extreme traits is known as _____.

9. _____ is a new feature that had not appeared in common ancestors before.

10. _____ is the theory that evolution occurs in small, gradual steps over time.

11. The reduced form of a functional structure that no longer performs its intended function that indicates shared ancestry is _____.

12. The morphological adaptation in which one species evolve to resemble another species for protection or other advantages is known as _____.

13. _____ is the theory that evolution occurs with relatively sudden periods of speciation followed by long periods of stability.

14. The random change in allelic frequencies in a population is known as _____.

15. _____ is diversification of a species into a number of different species, often over a relatively short time span.

16. The theory of evolution developed by Darwin, based on four ideas: excess reproduction, variation, inheritance, and the advantage of specific traits in an environment is _____.

17. The study of the distribution of plants and animals on Earth is _____.

18. _____ is an anatomically similar structure inherited from a common ancestor that has a different function amongst the species.

19. The most common form of natural selection in which organisms with an extreme expression of a trait is removed is _____.

20. _____ is the measure of a trait's relative contribution to the next generation.

Biology

Name_____ Biology Date_____

Period _____ Chapter 18 Bacteria and Viruses

Write an essay on viruses as to what they are, examples, lytic and lysogenic cycles, and how to prevent and/or recover from a viral infection.

AP Biology

Human Population Growth

Objectives:

You will create a graph of human population growth and use it to predict future growth.
You will identify factors that affect population growth.

Statisics on Human Population

Year A.D.	Number of People (in billions)
1650	.50
1750	.70
1850	1.0
1925	2.0
1956	2.5
1966	3.3
1970	3.6
1974	3.9
1976	4.0
1980	4.4
1991	5.5
2000	6.0
2004	6.4

Instructions for creating your graph.

Place time on the horizontal access. Values should range from 1650 to 2020.
Place number of people on the vertical access. Values should range from 0 to 20 billion.
Make sure that your graph is a full page in size and you have the correct labels for the X and Y access and a title for your graph.

Analysis

1. It took 1649 years fro the world population to double, going from .25 billion people to .50 billion people. How long did it take for the population to double once again?

2. How long did it take for the population to double a second time? _____ A third time? _____

3. Based on your graph, in what year will the population reach 8 billion? _____

4. Based on your graph, how many years will it take for the population of 2004 to double? _____

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p1 of 2

Solving a Simple Maze

Student Worksheet:
Design your own maze and solve it..

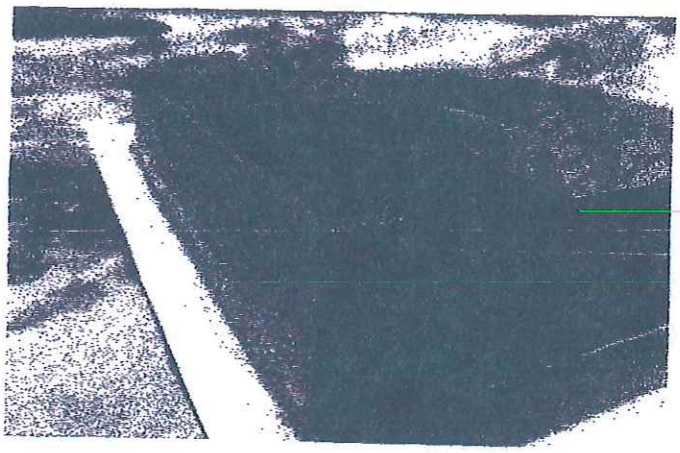
◆ You are working as a team of engineers who have been given the challenge to design a maze using the materials given to you, and then solve it. By this time, you might have already seen what a maze looks like, and some interesting maze solving robots. Before jumping into the real game, let's get started with building the maze. As you have seen, the maze consists of a platform and walls fitted onto it. Once you build your own maze with the dimensions suggested by your teacher, you will have to solve the maze – coming up with a step by step procedure you can give to the robot such that it can travel from source to destination. The maze has sixteen cells. The source is at the left bottom cell of the maze and the destination is at the right top of the maze.

◆ Planning

As a team, discuss among yourselves how to go about building the maze. You will have to decide what all materials you need. You can get them from your teacher. You may return materials, exchange materials with other teams. Consult with your teacher, if you need any clarification or doubts at this stage.

◆ Building

Take the material you use for the platform, say, the cardboard. Using the pencil or sketch pen, draw a layout of the maze on the platform. Share materials with other teams to build your maze. This is team work and it is important that you discuss among your team members and enjoy the spirit of working in a team. Share your thoughts and share your work. Listen to your friends, and help them out. Be sure to watch how other teams have designed their maze and how different the mazes are, compared to yours.



◆ Solving

Now it's time to start solving the maze. Take down the path in terms of the cell numbers, through which a mouse (a robot) has to travel to the reach the destination from the source. Now, think what made you arrive at your solution. Describe the logic behind your solution. Discuss among your friends and write it down.

It's important to think of the solution in terms of numbers. You can see the whole maze, and think about how to get from the source to the destination. However, you are much smarter than the robot. The robot cannot see the destination or understand the whole maze – the robot just knows the number of its current position and the numbers of the neighboring squares it can move to.

This is the real problem, how do you describe the solution to the robot? The robot doesn't know how to solve the maze. It only knows the source number is 1, and destination number is 16. So you have to give the robot a set of instructions such that the robot reaches the destination. Take down the instructions; consult your teacher for verification.

When you are doing this, think about how your solution would work if the maze was constructed differently. It is easy to design a solution if you know the maze beforehand, and simple tell the robot the moves it requires. However, can you come up with a solution that would work no matter what the pattern of the maze was? Can you think of ways of testing your solution?

◆ Evaluation

Use this worksheet to evaluate your team's results in this lesson.

1. Did you succeed in building the maze based on the figure given to you? If not, why?

2. Did you succeed in arriving at the solution for the maze? In other words, were you able to give the robot proper 'instructions' such that it could reach the destination? If not, why?

3. Did you negotiate any material trades with other teams? How did that process work for you?

4. Once you started building the maze, did you decide to change materials or add more materials?

5. Do you think that engineers have to stick to their original plan during the building stage? Why?

6. Do you think that the "building" stage helped you visualize the problem very clearly? If yes, how did it help you in solving the problem?

7. If you were working alone, would you have been able to complete the project easier? Explain.

8. Based on this activity, what do you think of algorithm development? Explain.

Pressure
(P) = atm, mmHg, torr, kPa

Temperature
(T) = K C°+273 K-273

Volume
(V) = L, mL, kL

Moles (n) - 6.02×10^{23}

Dalton's Law of Partial Pressure : $P_{total} = P_1 + P_2 + P_3 \ldots$

Boyle's Law : $P_1V_1 = P_2V_2$

Charles Law : $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

Avogadro's Law : $\frac{V_1}{n_1} = \frac{V_2}{n_2}$

* Combined Gas Law : $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

* Gay-Lussac's Law : $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

Ideal Gas Law : $PV = nRT$

Info Sheet

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Name:_____ Period:____

Combined Gas Law

What law do I use if neither temperature, nor pressure, nor volume is constant? Why, the combined gas law of course! The **combined gas law** is a gas law which combines Charles' law, Boyle's law, and Gay-Lussac's law.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

*When using the Combined Gas Law you must convert temperature from degrees Celsius to Kelvin.

Use the equation $K = °C + 273$

1. At a pressure of 405 kPa and a temperature of 200.K, the volume of a gas is 6.00 cm^3. At what pressure will the new temperature and volume be 300.K and 4.00 cm^3?

$P_1 = 405 kPa$
$V_1 = 6.00 cm^3$
$T_1 = 200 K$
$P_2 = X$
$V_2 = 4.00 cm^3$
$T_2 = 300 K$

① $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

② $\frac{405(6.00)}{200} = \frac{X(4.00)}{300}$

③ Butterfly: $2430 = 4.00X$, $200 \quad 300$

④ $\frac{800X}{800} = \frac{729000}{800}$ ← Solve for X

$X = 911.25$ (Count sig figs)

$X = 911$ kPa dont forget units

2. At 189 K and a pressure of 600.torr, a sample of nitrogen gas has a volume of 32.0 cm^3. What volume does the gas occupy at 242 K and 675 torr?

3. A volume of gas at 1.10 atm was measured at 22°C and 326 cm^3. What will be the volume if the gas is cooled to -10.°C and the pressure is adjusted to 1.90 atm?

4. The gas in a balloon occupies 2.25 L at 298 K and 300. kPa. At what temperature will the balloon expand to 3.50 L and 220 kPa?

5. A sample of gas has a volume of 852 mL at 25°C and 2.0 atm. What Celsius temperature is necessary for the gas to have a volume and pressure of 945 mL and 1.3 atm?

6. If 36.5 m^3 of a gas are collected at a pressure and temperature of 755 mm of Hg and 280 K respectively, what volume will the gas occupy if the pressure and temperature are changed to 632 mm of Hg and 305 K?

7. O_2 gas in a canister with a volume of 40. L at 25°C and 0.7 atm is compressed to a volume and pressure of 32.5 L and 1.4 atm. At this new volume and pressure what will the temperature of the gas be in degrees Celsius?

8. At a pressure of 13.6 atm, a gas occupies 62.1 cm^3 at a temperature of 80°C. If the temperature is raised to 110 °C, at what volume will the pressure be 8.9 atm?

AP/Dual Credit Chemistry (B. Trickey) for Week of March 30-April 3

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Review information attached and additional resources are found in Schoology. The access code for Schoology is **RTJ9-2CHT-554V3**

Questions

You are tasked with developing a procedure to determine the molar mass using titration. The unknown will be a solid monoprotic acid (HX) and you will use a standardized NaOH solution.

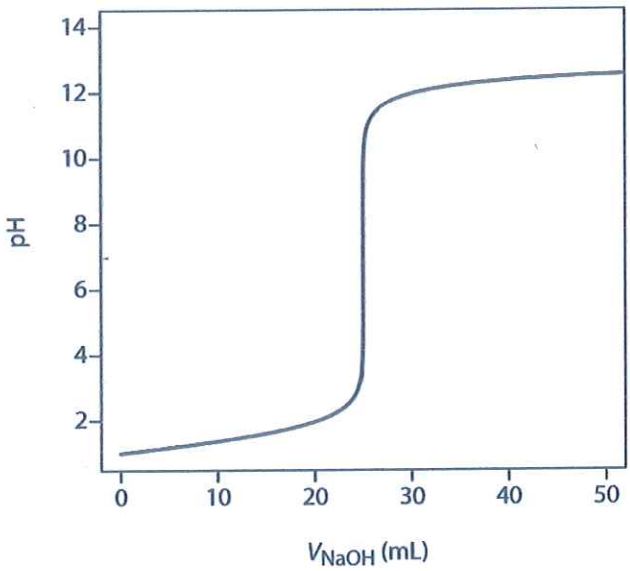
(a) Describe the measurement(s) that would have to be made to determine the number of moles of NaOH used in the titration.

(b) Write the chemical equation that would represent this reaction.

(c) How can the number of moles of the acid, HX, be determined.

(d) In addition to the measurements made in "c" what other measurements must be made to determine the molar mass of the acid, HA?

The titration curve (right) was obtained during the analysis.



(e) What is the pH at the equivalence point?

(f) If the NaOH solution has a concentration of 0.20M how many moles of the acid are present?

(g) Use table M to recommend a(n) appropriate indicator for this titration and explain your reasoning.

(h) Is the acid, HA, a strong or weak acid? Explain.

Explain how the following conditions would affect the titration results:

(i) The original solid acid, HA, was not completely dry at the beginning of the experiment.

(j) The dry acid, HA, was placed in an Erlenmeyer flask. Your procedure indicates that 25.00mL of water should be added but you mistakenly add 35.0mL of water.

Table M
Common Acid–Base Indicators

Indicator	Approximate pH Range for Color Change	Color Change
methyl orange	3.2–4.4	red to yellow
bromthymol blue	6.0–7.6	yellow to blue
phenolphthalein	8.2–10	colorless to pink
litmus	5.5–8.2	red to blue
bromcresol green	3.8–5.4	yellow to blue
thymol blue	8.0–9.6	yellow to blue

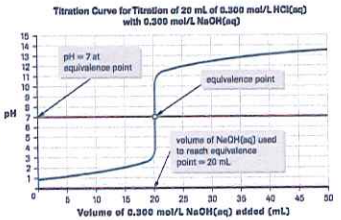
Acid-Base Titration Curves and Indicators

Section 8.5 (The last one!)
Pg. 333-339

Titration Curves

- A **titration curve** is a graph of the pH (vertical axis) versus the amount of the reagent progressively added to the original sample.
- As the **equivalence point** is approached, there is a rapid change in the pH.
- When a titration is done to create a **pH curve**, the addition of titrant is not stopped at the endpoint, but is continued until a large excess has been added.
- So what is happening?

- The initial addition of the titrant (in the burette) to the acid does not produce large changes. This relatively flat region of the pH curve is where a buffering action occurs.
- As the titration proceeds, and base is added, some of the acid is reacted with the added base, but anywhere before the equivalence point some excess acid will remain, so the pH stays relatively low.
- Very near the equivalence point, a small excess of acid becomes a small excess of base with the addition of a few more drops, so the pH abruptly changes.
- The equivalence point is the centre of this change, where the curve is the most vertical.



Pg 2.

What reaction is happening?

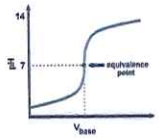
- $HCl_{(aq)} + NaOH_{(aq)} \rightarrow HOH_{(l)} + NaCl_{(aq)}$
- Net-ionic equation? Do you remember how?
- $H^+_{(aq)} + \cancel{Cl^-_{(aq)}} + \cancel{Na^+_{(aq)}} + OH^-_{(aq)} \rightarrow H_2O_{(l)} + \cancel{Na^+_{(aq)}} + \cancel{Cl^-_{(aq)}}$
- $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$ (net ionic equation)

For convenience, hydrogen ions are written in their simplest (Arrhenius) form

- Why was the equivalence point 7?
  - Remember water has a neutral pH of 7, and the spectator ions are neutral, so a strong monoprotic acid-strong monoprotic base titration must have a pH of 7 at the equivalence point.

Equivalence points

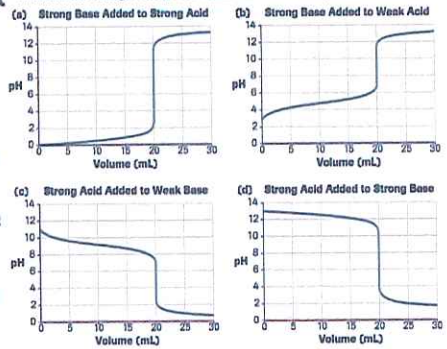
- It is important to note, that the equivalence point pH is 7 ONLY for **strong acid-strong base** reactions.



- For every other acid-base reaction, the equivalence point solution will contain ions or molecules that are not spectators – so titration curves must be done *empirically* to determine the equivalence point .

General Rule

Titrations Involving Monoprotic Acids and Bases of Equal Concentration

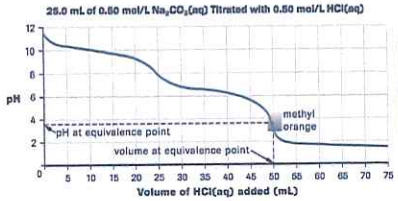


Strong Acid to Weak Base: pH at equivalence point is always lower than 7

Strong Base to Weak Acid: pH at equivalence point is always higher than 7

Strong Acid (HCl)- Weak Diprotic Base (Na_2CO_3)

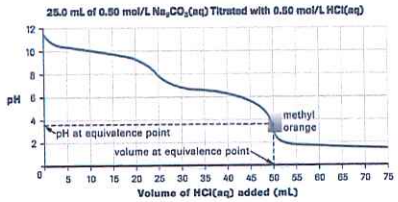
- The equivalence point is still below 7 but do you notice anything else?
- If you observe the curve closely, you see that there are **two places** where the curve steepens as the titration proceeds.
  - This happens because the base is diprotic, meaning that it will react with two hydrogen ions; so the hydrogen ions attach to the carbonate one at a time.
  - We use the second reaction equivalence point, because we want the pH value when the reaction is complete.



Why does the curve start at the top? Because now a strong acid is being added to the weak base, not vice versa

Strong Acid (HCl)- Weak Diprotic Base (Na_2CO_3)

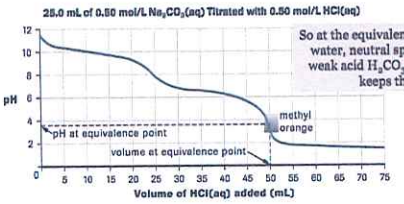
- $CO_3^{2-}{}_{(aq)} + H^+_{(aq)} \rightarrow HCO_3^-{}_{(aq)}$ – first equivalence point
- $HCO_3^-{}_{(aq)} + H^+_{(aq)} \rightarrow H_2CO_{3(aq)}$ – second equivalence point
- Net reaction:
- $CO_3^{2-}{}_{(aq)} + 2H^+_{(aq)} \rightarrow H_2CO_{3(aq)}$



You will want to choose an indicator that changes color at the second equivalence point

Strong Acid (HCl)- Weak Diprotic Base (Na_2CO_3)

- Why is the equivalence point less than 7???
- Balanced reaction: $Na_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + H_2CO_{3(aq)}$
- Net ionic equation:
- $2Na^+_{(aq)} + CO_3^{2-}{}_{(aq)} + 2H^+_{(aq)} + 2Cl^-_{(aq)} \rightarrow 2Na^+_{(aq)} + 2Cl^-_{(aq)} + H_2CO_{3(aq)}$

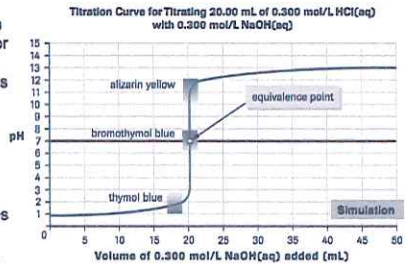


So at the equivalence point, there is neutral water, neutral spectator ions, and some weak acid $H_2CO_{3(aq)}$. What do you think keeps the pH below 7?

Why do we care about titration curves?

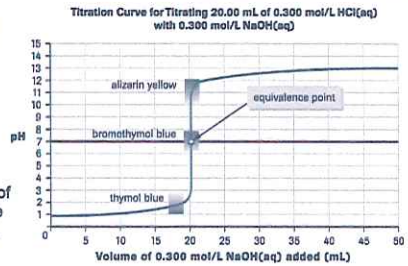
- Acid base reaction pH curves provide a wealth of information:
  - Initial pH levels
  - Equivalence point volume of titrant
  - Number of reaction steps
  - Equivalence point pH for **indicator selection**; so the endpoint observed for the indicator chosen will closely match the equivalence point of the reaction

- **Thymol blue** is an unsuitable indicator for this titration because it changes colour before the equivalence point (pH 7).
- **Alizarin yellow** is also unsuitable because it changes colour after the equivalence point.



- **Bromothymol blue** is suitable because its endpoint pH of 6.8 (assume the middle of its pH range) closely matches the reaction equivalence point pH of 7, and the colour change is completely on the vertical portion of the pH curve.

Final Tips



- It is also critical that the amount of indicator used be extremely small.
- Some of the titrant volume is used to react with the indicator to make it change color. But if the amount of indicator is small, the volume of titrant used this way will be very small, and the accuracy of the titration will not be affected.

Summary

- An indicator for an acid–base titration analysis must be chosen to have an endpoint (change of colour) at very nearly the same pH as the pH at the equivalence point of the reaction solution.
- The pH of the solution at the equivalence point for a strong monoprotic acid–strong monoprotic base reaction will be 7.
- The pH of the solution at the equivalence point for any other acid–base reaction must be determined experimentally, by plotting a titration pH curve.

Homework

- Titration Curve Practice Problems - overhead
- Pg. 336 #1-4
- Pg. 339 #1-3, 5-7, 9

Pre-AP Physics (L. Russell)
Assignment for Week March 30 – April 3

These materials are on the Georgia Public Broadcasting website. Watch the internet video about waves using this link: https://www.gpb.org/physics-fundamentals/episodes/1101

These files are found on the same web page as the video above. Complete the Note Taking Guide as you watch the video.

Note Taking Guide

Perform the Pendulum Lab using household materials and fill out the "Wave Properties on a Spring" sheet.

Pendulum Lab
Instructions – Pendulum
Wave Properties on a Spring

Dual Credit Physics (L. Russell)
Assignment for Week March 30 – April 3

In order to allow you to receive credit for Physics 1402 through the college, we are transitioning the course to online through the NTCC website. The instructions for accessing the materials are on Schoology. Here is the access code for the course on Schoology if you need it. 9CRC-PSDJ-X3WGN I have two assignments for the week listed there. Be sure to set up your Webassign access using the procedures outlined in Schoology in order to complete the homework assignments. Don't use your textbook to complete the assignments since the numerical values in the textbook won't match the numerical values in the problems on Webassign even though they are the same problems.

AP Physics C (L. Russell)
Assignment for Week March 30 – April 3

Go to apcentral.collegeboard.org and click on the "Learn how we're supporting schools" tab that you see in the screenshot below. Then click on the "free remote learning resources" tab on the next screen. The next page will list the different AP courses. Go down and click on AP Physics C Mechanics and it will open a list of video lessons that the College Board is providing now for AP students. The AP exam will not cover oscillations or gravitation this year due to the shortened schedule. I posted an old AP exam on Schoology in the folder "AP Review Materials". Here is the access code for our Schoology course if you need it. J4ZN-CXRF-7RFF9 You can take a picture of your answers with your phone and submit using Schoology and I'll check it for you.