



Stamford Public Schools

EXCELLENCE IS THE POINT.

Stamford Public Schools

Science Department

District Midterm Examination

REVIEW

2015-2016

Honors Biology

Student Name: _____

School/Teacher: _____

Date: _____



Dear Biology Student,

The district-wide Honors Midterm Exam for the 2015-2016 school year will focus on the concepts covered in each of the first two quarters of the Biology course. You will have 90 minutes for this exam.

Enclosed is a list of the skills and concepts from your Biology course. Next to each main topic is the number of problems which will appear on the Exam and also the way questions will be formatted (Constructed Response or Selected Response).

In addition to the concepts listed and the formatting of the questions, this packet also includes a sampling of the types of questions which will be on your Honors Biology Midterm Exam.

Please see your science teacher if you feel additional practice is necessary.

Wishing you success on your Exam,

Carrie Chiappetta,
Director for Math and Science

Honors Biology Midterm Exam 2016

Blueprint and Study Guide

51 selected response questions – 1 point each

11 constructed response questions – 21 points total

72 points total

Topic	# of selected response questions (1 pt per question)	# of constructed response questions	points assigned to constructed response questions
Chemistry of Life: 13 points	10 total	1 total	3 points
Enzyme structure and function	2		
Activation energy	1		
Properties of water	2		
Synthesis of macromolecules	1		
Structure & function of macromolecules	4		
Enzyme lab data interpretation		1	3
Structure and Function of Cells: 13 points	10 total	1 total	3 points
Homeostasis	1		
Properties of life	1		
Eukaryotic v. prokaryotic cells	2		
Plant v. animal cells	1		
Organelle structure and function	2		
Active v. passive transport	1		
Osmosis	1		
- Predicting movement of water - hyper/hypo/isotonic	1		
		1	3 points
Photosynthesis and Respiration: 21 points	6 total	7 total	11 points
<i>Reactants and Products of photosynthesis and/or respiration:</i>	<i>4 total</i>	3	5 points
- General content	1		
- Glycolysis			
- Electron transport chain	1		
- Krebs cycle			
- Light dependent reactions	1		
- Light independent reactions	1		
Fermentation	1		
Locations of reactions	1		
Yeast population lab data		4	6
DNA, Protein Synthesis, and Biotechnology: 18 points	14 total	2 total	4 points
Structure & function of DNA & RNA	2		
Compare/contrast DNA & RNA	1		
Parts of a DNA nucleotide	1		

<i>DNA replication</i> - General content - Base pairing rules	<i>3 total</i> 1 2		
<i>Transcription & translation</i> - General content - Functions of rRNA, tRNA, mRNA - Codons	<i>3 total</i> 1 1 1		
<i>Recombinant DNA & genetic engineering</i> - General content - Transgenic plants	<i>4 total</i> 2 2	2	4
Cell Division and Sexual Reproduction: 11 points	11 total	0 total	0 points
<i>Stages of the cell cycle</i> - General content - Stages of interphase - Stages of mitosis	<i>5 total</i> 2 1 2		
<i>Sources of genetic variation</i> - General content - Crossing over	<i>2 total</i> 1 1		
Chromosome number in body cell division v. sex cell division	1		
Meiosis	1		
Cancer	1		
Karyotypes	1		
The Nature of Science	<i>Found in conjunction with questions throughout the assessment.</i>		

Science Process

You should be able to:

- Design experiments that test specific science questions
- Identify the independent/dependent variables and control if applicable
- Demonstrate a knowledge of common lab equipment and measurement units
- Write a reasonable hypothesis based on prior knowledge
- Read and interpret graphs, tables and diagrams
- Analyze data and observations to form reasonable conclusions
- Demonstrate an understanding of error related to the validity of data
- Apply mathematics to solving quantitative problems as applied to science
- Use common science language and vocabulary correctly
- Find logical connections between science concepts and applications in the real world.
- Evaluate information based on science practice
- Identify and emphasize interdisciplinary connections

- Explain how science understanding is challenged and developed through rigorous testing of concepts, theories and laws

On pages 6-17 you will find objectives and practice questions units 2-6. In addition, be sure to review all the lab work you have completed throughout the year.

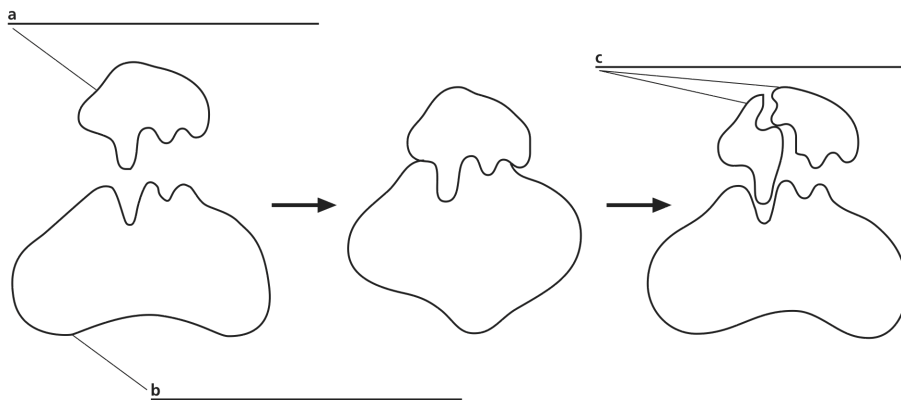
Unit 2: The Chemistry of Life

Objectives

- A. Describe the structure of a water molecule. Identify which part of the molecule is (+) and which part of the molecule is (-)
- B. Describe how enzymes affect chemical reactions in organisms. Explain the induced fit model of enzyme functioning.
- C. Compare dehydration synthesis and hydrolysis reactions. When is each used?
- D. Identify and describe the structures of carbohydrates, lipids, and proteins. Be able to identify the subunits that compose these macromolecules.

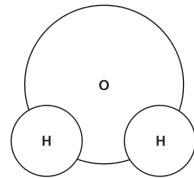
Practice Questions:

1. The diagram below shows the interaction of an enzyme and its substrate during a chemical reaction. Label the diagram and *explain* how the enzyme is functioning to help break down the substrate.

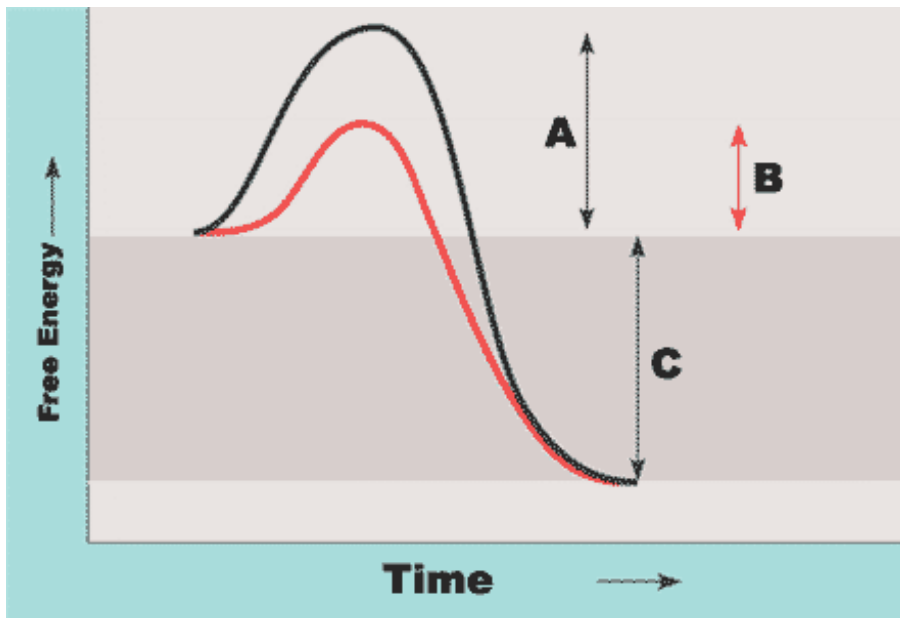


2. Most enzymes
 - a. are changed by the reactions they catalyze.
 - b. increase the activation energy of the reactions they catalyze.
 - c. strengthen the chemical bonds in their substrate.
 - d. are sensitive to changes in temperature or pH
3. What two things allow an enzyme to work most efficiently?
 - a. correct temperature and correct catalysts
 - b. correct temperature and correct pH
 - c. correct pH and correct substrates
 - d. correct substrate and correct metabolism
4. What type of reactions build proteins from amino acids?
 - a. dehydration synthesis reactions
 - b. catalytic reactions
 - c. hydrolysis reactions
 - d. metabolism synthesis reaction

5. The diagram below represents a single water molecule. Indicate what part of the molecule is slightly (+) and what part is slightly (-). Draw three other water molecules near it, and use dashed lines to indicate where hydrogen bonds would form between the molecule shown below and the ones you drew.



6. The graph below shows the change in energy of a catalyzed v. uncatalyzed chemical reaction.



- Label A, B, and C.
- Explain the data shown on the graph.

Unit 3: Structure and Function of Cells

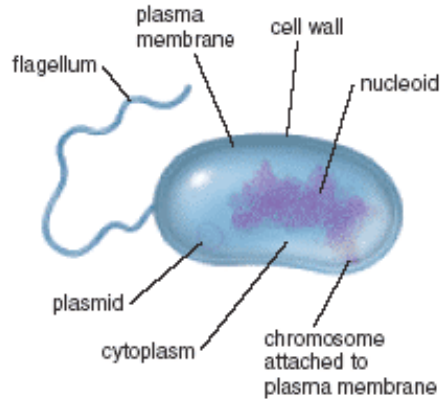
Objectives

- A. Distinguish between prokaryotes and eukaryotes.
- B. Describe the structure, composition and function of the cell membrane.
- C. Describe the structure and function of the major organelles found in a eukaryotic cell.
- D. Compare and contrast plant and animal cells.

Practice Questions

1. One difference between eukaryotic and prokaryotic cells is that only
 - a. prokaryotic cells are surrounded by a cell membrane.
 - b. prokaryotic cells have a nucleus.
 - c. eukaryotic cells have genetic information.
 - d. eukaryotic cells have membrane-bound organelles.
2. The plasma membrane
 - a. allows all substances to pass into and out of the cell.
 - b. prevents all substances from passing into and out of the cell.
 - c. is composed mainly of a protein bilayer.
 - d. is composed mainly of a lipid bilayer.
3. Substances produced in a cell and exported outside of the cell would pass through the
 - a. endoplasmic reticulum and Golgi apparatus
 - b. mitochondria and Golgi apparatus.
 - c. nucleus and lysosomes. Golgi apparatus.
 - d. vacuoles and lysosomes
4. Which of the following organelles is found in plant cells but not in animal cells?
 - a. nucleus
 - b. chloroplast
 - c. mitochondrion
 - d. Golgi bodies
5. When a human red blood cell is placed in a hypotonic environment, it will
 - a. undergo cytolysis.
 - b. undergo plasmolysis.
 - c. experience a decrease in turgor pressure.
 - d. be at equilibrium.
6. Which of the following involves the movement of substances across cell walls against their concentration gradients?
 - a. passive transport
 - b. endocytosis
 - c. facilitated diffusion
 - d. active transport

7. What type of cell is pictured, and how can you identify it?



- a. It is a prokaryotic plant cell because it has a cell wall.
- b. It is a eukaryotic plant cell because it has a cell wall.
- c. It is a eukaryotic cell because it has a flagella.
- d. It is a prokaryotic cell because it has a nucleoid (region).

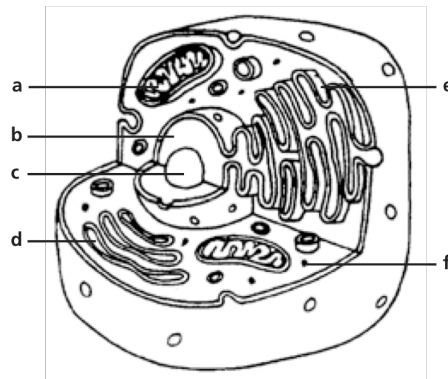
8. What is the function of a selectively permeable membrane?

- a. provides alternative to phospholipid bilayer
- b. prevents transport proteins from harming the cell
- c. controls what enters and leaves the cell
- d. block all water from entering the cell.

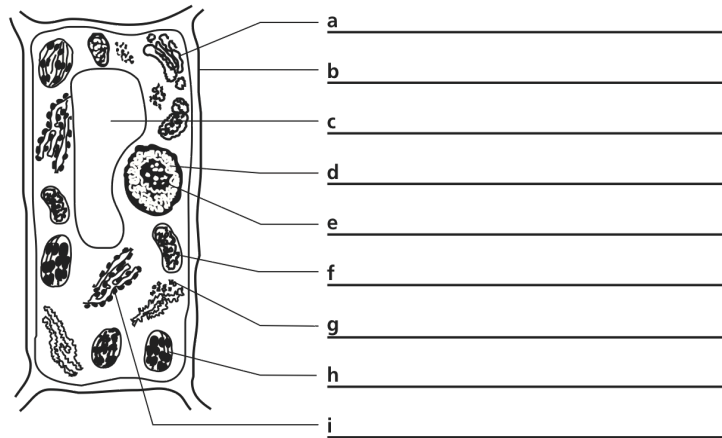
9. Which of the following is not a function of the Golgi apparatus?

- a. modifies proteins
- b. produces proteins
- c. organizes where proteins are sent
- d. packages proteins into vesicles

10. This diagram represents a typical animal cell. Label each part of the figure. Be sure you are able to indicate the function of each structure if asked.



11. The diagram below represents a typical plant cell. Label each part of the figure. Be sure you are able to indicate the function of each structure if asked.



12. The drawings below show the appearance of a red blood cell and a plant cell in isotonic, hypotonic, and hypertonic environments. Label each environment in the spaces provided.

RED BLOOD CELL



a _____

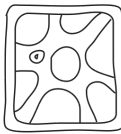


b _____

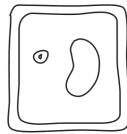


c _____

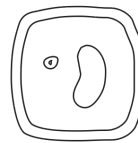
PLANT CELL



d _____



e _____



f _____

Unit 4: Photosynthesis and Respiration

Objectives

- A. Explain how the structure of the chloroplast is related to its function.
- B. Summarize the main events of electron transport in a chloroplast.
- C. Describe what happens to a water molecule in photosynthesis.
- D. Explain how ATP is synthesized during the light reactions.
- E. Summarize the main events of the Calvin cycle.
- F. Describe the major events in glycolysis.
- G. Summarize the events of the Krebs cycle
- H. Summarize the events of the electron transport chain in mitochondrion.
- I. Relate aerobic respiration to the structure of a mitochondrion.

Practice Questions

1. The photosystems and electron transport chains are located in the
 - a. outer chloroplast membrane.
 - b. inner chloroplast membrane.
 - c. thylakoid membrane.
 - d. stroma.
2. Water participates directly in the light reactions of photosynthesis by
 - a. donating electrons to NADPH.
 - b. donating electrons to photosystem II.
 - c. accepting electrons from the ETC
 - d. accepting electrons from ADP.
3. The energy that is used to establish the proton gradient across the thylakoid membrane comes from the
 - a. synthesis of ATP.
 - b. synthesis of NADPH.
 - c. passage of electrons along the ETC of PS II.
 - d. splitting of water
4. For every three molecules of CO₂ that enter the Calvin cycle, the cycle produces six molecules of
 - a. RuBP.
 - b. ATP.
 - c. 3-PGA.
 - d. NADPH.
5. Glycolysis takes place
 - a. in the cytosol.
 - b. in the mitochondria.
 - c. only if oxygen is present.
 - d. only if oxygen is absent.
6. The Krebs cycle
 - a. produces two molecules of CO₂.
 - b. produces a 6-carbon molecule from 6 molecules of CO₂.
 - c. produces NAD⁺ from NADH and H⁺.
 - d. generates most of the ATP produced
7. The electron transport chain of aerobic respiration
 - a. generates O₂ from H₂O.
 - b. produces NADH by chemiosmosis.
 - c. pumps electrons into the mitochondrial matrix.
 - d. pumps protons into the space between the inner and outer mitochondrial membranes.

8. What cellular process actually produces most of the ATP?
- a. absorption of light
 - b. Krebs cycle
 - c. fermentation
 - d. electron transport
9. In cellular respiration, ___ gas is required and ___ gas is given off as a waste product.
- a. hydrogen, oxygen
 - b. carbon dioxide, oxygen
 - c. oxygen, carbon dioxide
 - d. nitrogen, oxygen
10. The light reactions of photosynthesis convert visible light into what?
- a. chemical energy
 - b. sugar
 - c. oxygen
 - d. carbon dioxide
11. In the second part of photosynthesis, the Calvin cycle, uses ATP and NADPH energy to convert carbon dioxide into what?
- a. oxygen
 - b. sugars
 - c. waste products
 - d. chloroplasts
12. What are the forms of chemical energy created during photosynthesis before the Calvin cycle?
- a. ATP and NADPH
 - b. ADP and NADPH
 - c. ATP and NADP^+
 - d. ADP and NADP^+
13. Write the equations for cellular respiration and photosynthesis. Explain the equations in words.

Unit 5: DNA, Protein Synthesis, and Biotechnology

Objectives

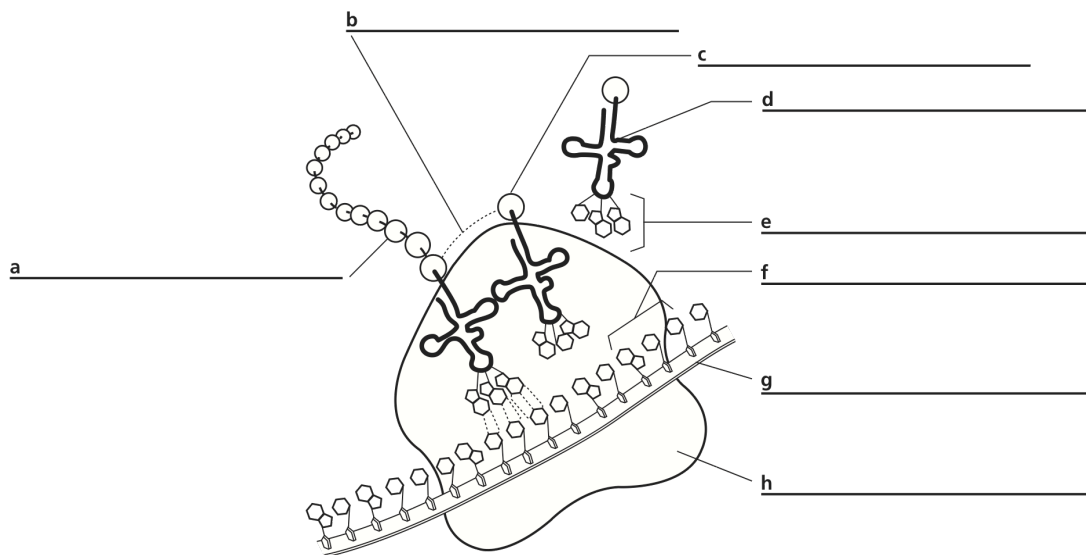
- A. Explain the principal function of DNA.
- B. Describe the structure of DNA.
- C. Explain the role of complementary base pairing in the replication of DNA.
- D. Compare the structure of RNA with that of DNA.
- E. Describe the structure and function of each type of RNA (mRNA, tRNA, rRNA)
- F. Describe the genetic code.
- G. Distinguish between the processes of transcription and translation.
- H. Discuss the uses of genetic engineering in medicine.
- I. Describe two ways genetic engineering has been used to improve crop plants.
- J. Discuss environmental and ethical issues associated with genetic engineering.

Practice Questions

1. The primary function of DNA in cells is to
 - a. serve as a storage form for unused nucleotides.
 - b. occupy space in the nucleus to keep the nucleus from collapsing.
 - c. store information that tells the cells which proteins to make.
 - d. serve as a template for making long, spiral carbohydrates.
2. According to the base-pairing rules, guanine binds with
 - a. cytosine.
 - b. adenine.
 - c. thymine.
 - d. guanine.
3. Which of the following is NOT a correct structure of a nucleotide?
 - a. adenine—deoxyribose—phosphate
 - b. adenine—ribose—phosphate
 - c. cytosine—deoxyribose—phosphate
 - d. guanine—deoxyribose—phosphate
4. The percentage of adenine in DNA is
 - a. equal to the percentage of cytosine.
 - b. equal to the percentage of thymine.
 - c. not related to the percentage of thymine.
 - d. equal to the percentage of guanine.
5. Which of the following distinguishes RNA from DNA?
 - a. It stores genetic information.
 - b. There are multiple type of RNA
 - c. It is a nucleic acid.
 - d. It is a biomolecule.
6. DNA technology is being used to develop crop plants that are
 - a. less toxic to the pests that normally feed on them.
 - b. more susceptible to herbicides.
 - c. unable to fix nitrogen in the atmosphere.
 - d. resistant to some diseases.
7. Scientists have inserted genes into rice plants that
 - a. code for enzymes that cause rice to ripen quickly.
 - b. increase the iron and beta-carotene levels.
 - c. code for substances that cause allergies in people.
 - d. increase the thickness of the seed coat.

8. Some people are concerned that genetically engineered crop plants could
- transmit their new genes to wild plant species, producing “super-weeds.”
 - transmit their new genes to the animals that eat the plants, producing “super-animals.”
 - exchange genes with animals, producing plant-animal hybrids.
 - be wiped out by native plant species.

9. The diagram below summarizes the events that occur during translation. Label each part of the figure in the space provided and summarize the process.



Unit 6: Cell Division and Sexual Reproduction

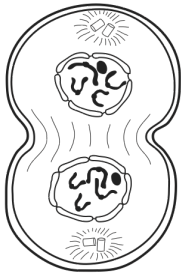
Objectives

- A. Describe each phase of the cell cycle (Interphase and mitosis).
- B. Summarize the phases of mitosis (PMAT)
- C. Compare cytokinesis in animal cells with cytokinesis in plant cells.
- D. List and describe the products of meiosis.
- E. Compare the end products of mitosis with those of meiosis.
- F. Explain crossing over and how it contributes to the production of unique individuals.

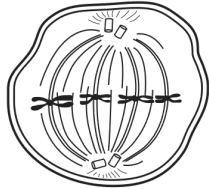
Practice Questions

1. Which of these is not a stage of the cell cycle?
a. cytokinesis b. interphase c. mitosis d. photosynthesis
2. What typically results from one completed cell cycle?
a. tissue b. dead cells c. new cells d. genomes
3. In eukaryotic cells, DNA is copied during a phase of the cell cycle called
a. M phase. b. S phase. c. G1 phase. d. G2 phase.
4. What is the primary function of mitosis during the cell cycle?
a. phagocytosis c. osmosis
b. DNA replication d. separation of replicated DNA
5. The cytoplasm of a eukaryotic cell divides by a process called
a. mitosis. b. meiosis. c. replication. d. cytokinesis.
6. DNA replication takes place ___ during meiosis.
a. once b. twice c. four times d. six times
7. During crossing-over, portions of chromatids
a. double the amount of DNA in each chromosome
b. move from autosomes to sex chromosomes.
c. break off and attach to adjacent chromatids on the homologous chromosome.
d. separate from each other and move to opposite poles of the cell.
8. Crossing over results in _____.
a. the removal of genotypes from a zygote
b. less genetic variation
c. fewer combinations of genes
d. greater genetic variation
9. The major distinguishing characteristic of cancer is
a. uncontrolled cell division. c. metastasis.
b. production of viruses. d. tumor formation

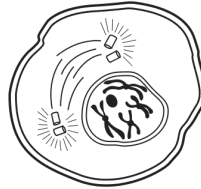
10. Label each figure with the phase of mitosis that it represents. Summarize what is happening in each phase.



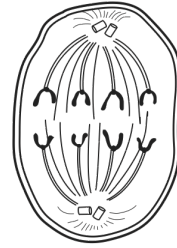
a _____



b _____

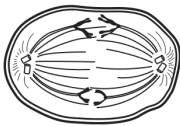


c _____

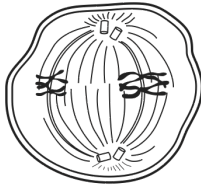


d _____

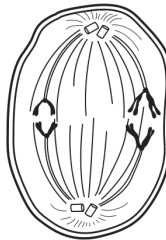
11. Label each figure with the phase of meiosis that it represents. Summarize what is happening in each phase.



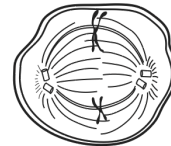
a _____



b _____

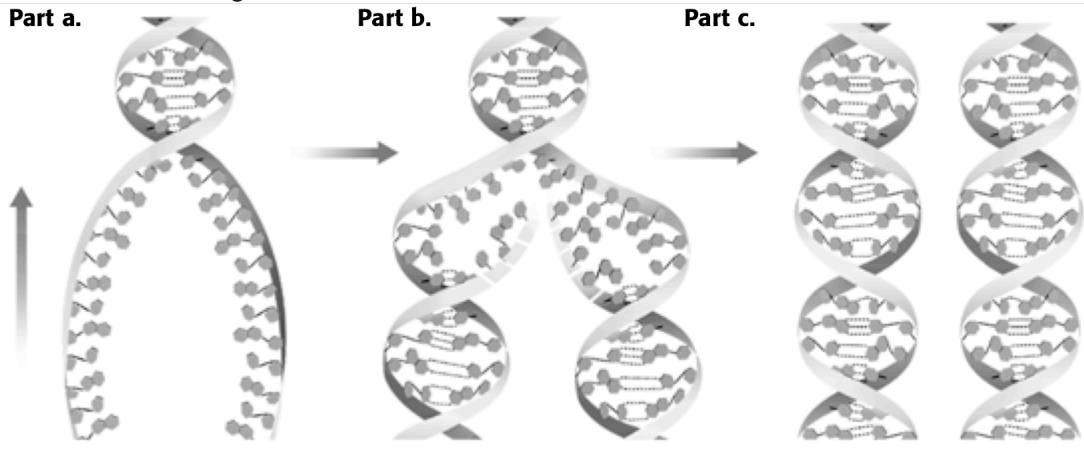


c _____



d _____

12. The figure below shows DNA replicating. In the space provided, describe what is occurring at each lettered section of the figure.



13. What is the picture below and how can it be used to determine the sex of a person?

