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Event Description

- **Goal:** Test *knowledge and process skills* in Cell Biology and Biochemistry
- **Knowledge** = Understand concepts and Memorize information
- **Process Skills** = Critical thinking and Scientific inquiry
(predict, hypothesize, design experiment, interpret data)

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Rules

- Team of 2 students
- Reference materials not allowed
- Things to Bring:
 - Non-programmable calculator
 - Approved safety goggles
 - Pencils/Pens/Eraser

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Rule Updates for 2009

- No changes in the topics for study from 2008
- Lab-setup left to the discretion of Event Supervisor

| Rule Category | 2008 | 2009 |
|--------------------------|---|---|
| Description | "is a lab-oriented competition" | deleted |
| Competition | May be administered as a series of stations | May be administered as a series of "lab-practical" stations |
| Sample Questions h and i | Identify using test reagents / calculate using data obtained from calorimeter | Addition to 2008 "or data provided" |

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Competition

- Identical Topics for Regional and State levels
- Additional topics for the National Competition
- Regional level - stations or written exam
- State level - most likely stations
- Multiple choice, matching, fill-in the blanks, label diagrams, questions on interpretation of graphs, extrapolation from simple graphs, simple reagent tests, short answers, experimental set up etc

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Monomers and Polymers in a Cell

Carbohydrates, proteins, fats and nucleic acids

- Monomers
- Polymers
- Tests for identification
- Function
- Structure

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pH

$\text{pH} = -\log[\text{H}^+]$

Increasing acidity ← neutral → Increasing basicity

| | | | | | |
|----------------|--------|-----------|-----------|------------|------------|
| pH | 0 | 4 | 7 | 10 | 14 |
| $[\text{H}^+]$ | 10^0 | 10^{-4} | 10^{-7} | 10^{-10} | 10^{-14} |

$[\text{OH}^-] = 10^{-14}$ 10^{-10} 10^{-7} 10^{-4} 10^0

H^+ OH^-

https://www.collegeboard.org/apc/collegeboard/chemistry/chem/2017/17/pH
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Physiological Relevance of pH

Effect of pH on the release of O_2 from Hb:

1. At which pH is O_2 delivered mostly efficiently to tissues?
2. Under what conditions would you expect acidic pH in a tissue?
3. Calculations of O_2 release.

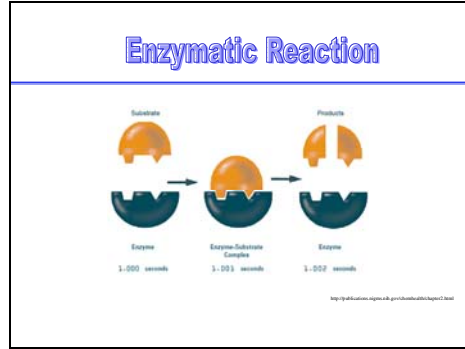
https://www.collegeboard.org/apc/collegeboard/chemistry/chem/2017/17/pH

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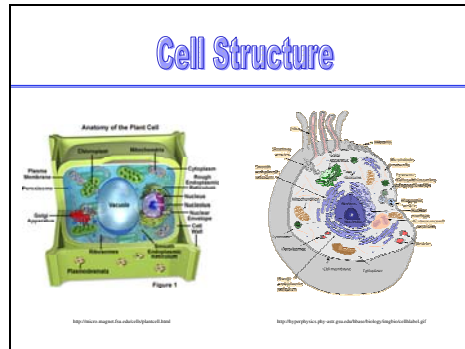
Enzymes

- Proteins or ribonucleoproteins
- Catalysts
- Monomeric or multimeric
- Homomers or heteromers
- Cofactors/coenzymes/prosthetic groups
- Sensitivity and Specificity

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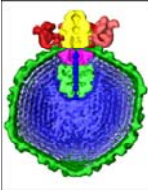
Function of Organelles

- Special features of plant and animal cells
- Differences between plant and animal cells
- Structure and function of organelles
- Possible stations:
 - Label diagram of a cell
 - Match organelle with function
 - Calculate size of a cell
 - Analyze function of organelles in specialized cells

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Structure of a Virus

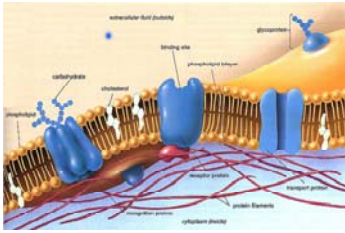
- Parasites - Need host cell to reproduce
- Infect bacteria, plants and animals
- Different shapes
- DNA/RNA
- Protein capsid
- Envelope



Structure of epsilon15 bacteriophage, a virus that infects Salmonella. One end of the DNA genome (blue) is poised for injection into a host cell. Credits: Wai-Chi Nature(2006)

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Cell Membrane

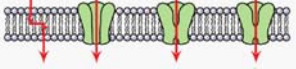


http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1487107/

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Passive vs. Active Transport

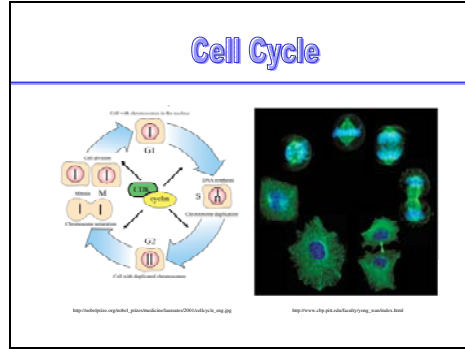
| Passive | | Active | |
|---------------|-------------|------------|------------------|
| No Saturation | Nonmediated | Saturation | Carrier mediated |
| A | B | C | D |



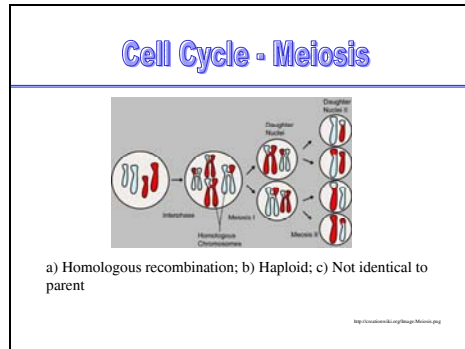
Passive Diffusion: No energy, concentration gradient
Active Diffusion: Energy, low to high concentration

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1487107/

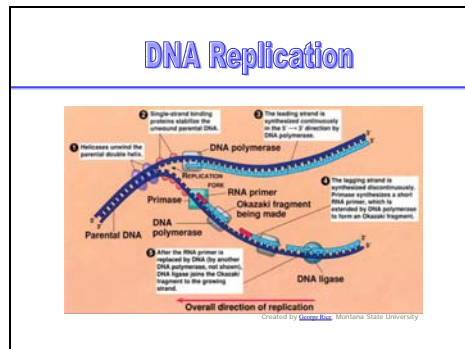
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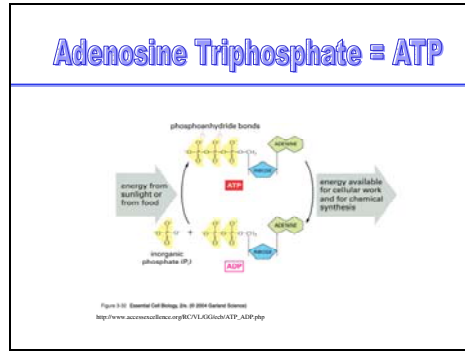
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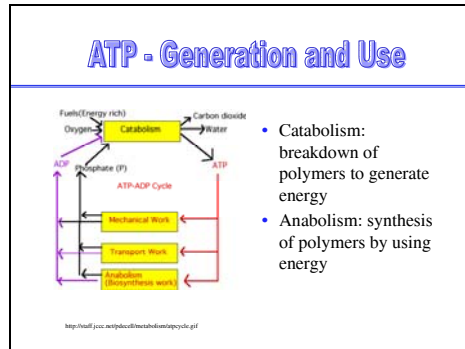
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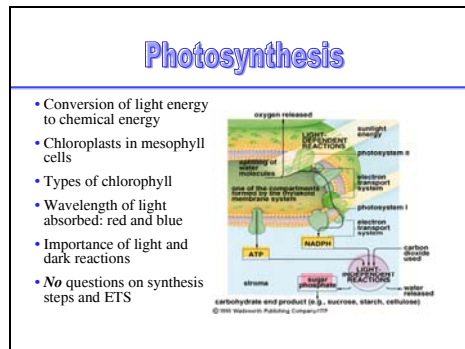


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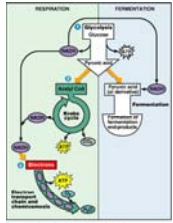
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Respiration

- Oxidation of food to produce energy
- Two stages: Glycolysis and Krebs Cycle
- Occurs in cytoplasm and mitochondria
- *No* questions on number of ATP molecules generated



The diagram illustrates the metabolic pathways of cellular respiration and fermentation. It shows the breakdown of glucose into pyruvate through glycolysis in the cytoplasm. Pyruvate can then enter the mitochondrion for aerobic respiration, which includes the Krebs cycle and the electron transport chain, leading to the production of ATP and water. Alternatively, pyruvate can undergo fermentation in the cytoplasm, which includes lactic acid fermentation or alcoholic fermentation, also producing ATP.

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Energy Content of Food

- Fat: 9 calories/gram
- Protein: 4 calories/gram
- Carbohydrates: 4 calories/gram
- 1 Food Calorie (C) = 1000 calories = 4.184 kJ of heat energy
- How many total calories are present in a McDonald's Double Cheeseburger that contains 23g of fat, 34g of carbohydrates and 25g of protein? What percent of calories would be obtained from the fat content of the burger?

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Calorie Content of a Burger

Answers:

- 443 calories
- 46.7 % from fat

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Resources

- Web searches in Google with key terms
- http://soinc.org/cell_biology_c
- http://ull.chemistry.uakron.edu/genobc/Chapter_21/
- <http://www.estrellamountain.edu/faculty/farabee/biobk/biobooktoc.html>
- <http://www.biology.arizona.edu/DEFAULT.HTML>
- <http://www.youtube.com>
(YouTube has some very informative biology videos)

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Questions ???

- Interpretation of Rules by the Event Leader at the Regional and State level will impact the format of the test.
- Questions about the Regional Tournament, should be e-mailed to the Regional Director.
- Queries regarding the State Event, should be sent to State Director, Jason Painter.
