Science 9 PAT Review

PAT Rules Overview

Come Prepared - Pencil, Eraser & Calculator, book for after you are done

You may bring WATER in a bottle

NO CELL PHONES - these must be turned in to the caddy at the front of the room at the start. Will be returned at the end.

Test Format

55 Selected Response Questions

- 50 Multiple Choice
- 5 Numerical Response

11 questions for each of the 5 units:

Biological Diversity
Matter and Chemical Change
Environmental Chemistry
Electrical Principles and Technology
Space Exploration

Overall Hints

Skill Testing Questions- Literally

Most questions will have a set of data, diagram, graph or table with information for you to interpret

Ask Questions - if you are not sure if I can answer - ask anyway, I will let you know!

Scientific Method Review

Manipulated Variable - Changed by the experimenter

Responding Variable - Result of the change. Can be measured quantitatively or described qualitatively.

Controlled Variables - Other variables that MUST be kept the same so the experiment is valid and reliable. This makes the test FAIR.

Tomatosphere

What was the Manipulated Variable?

What was the Responding Variable?

What was Controlled?

Practice!

Susie wants to know if electrochemical cells will vary if she changes the type of electrodes. She sets up four cells:

- two copper electrodes
- one Zn, one Cu
- one Al, one Cu
- one Pb, one Cu

Questions

What is the Manipulated Variable?

What could be the Responding Variable?

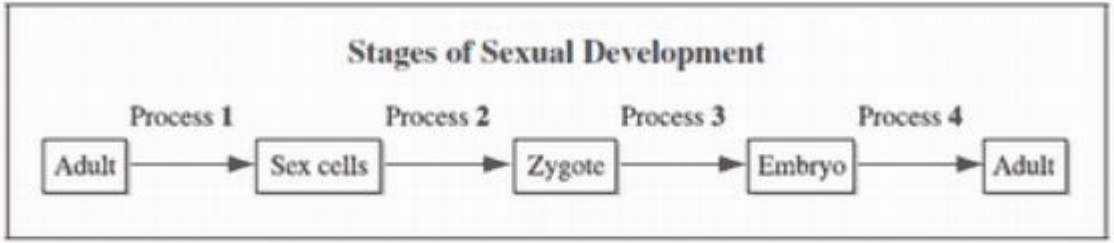
What should be controlled to make the experiment FAIR?

Biological Diversity Review!

Main Concepts:
- Diversity and Variation - importance, location, continuous vs discrete
- Niches, Generalists/Specialists, Symbiosis, Adaptations
- Reproduction (Sexual/Asexual), Meiosis, Pollination, Fertilization, Mitosis, stages in sexual reproduction and development.
- Genetic Variation - DNA Structure, Dominance/Recessive, inherited traits chromosome numbers
- Artificial vs Natural Selection
- Extinction, extirpation, endangered
- Conservation - zoos, national parks, seed banks, treaties

PAT Sample Questions

Let’s look at some of the PAT SAMPLE QUESTIONS together



In the flowchart above, the stage at which fertilization takes place is labelled

A. Process 1
B. Process 2
C. Process 3
D. Process 4

Information About Army Cutworm Larvae

- Army cutworm larvae eat the foliage of many commercial crops (e.g., wheat, alfalfa).
- Army cutworm larvae feed from April to the end of May, at which time they develop into moths.
- A tiny wasp (*Copidosoma*) parasitizes army cutworm larvae by laying a single egg in a larva.
- Army cutworm larvae that are parasitized remain in the larval stage longer than those that are not parasitized.

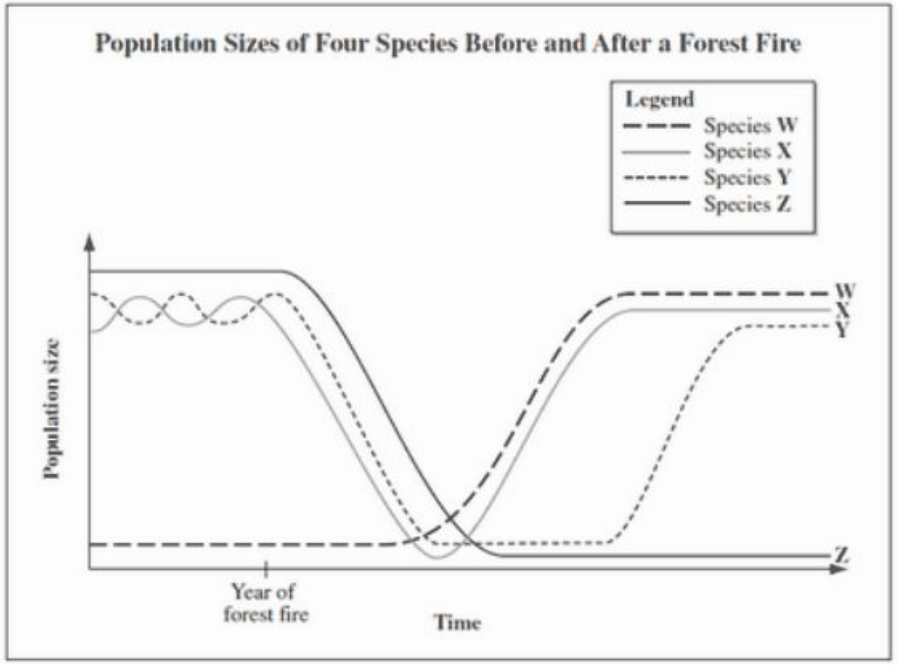
If the population of *Copidosoma* is large, then the quality of wheat crops will

A. increase, because there will be fewer larvae to feed on the crops
B. decrease, because there will be fewer larvae to feed on the crops
C. increase, because larvae will feed on the crops for a longer time
D. decrease, because larvae will feed on the crops for a longer time

Human cells normally have 46 chromosomes. Klinefelter syndrome results when human cells have 47 chromosomes.

Klinefelter syndrome is the result of a defect that occurs during

A. mitosis
B. meiosis
C. artificial selection
D. asexual reproduction



Given the trends on the graph shown above, which species has the broadest niche?

A. W
B. X
C. Y
D. Z

- Wolves prey on elk.
- Elk consume willow shrubs.
- Willow shrubs along stream banks provide shade.
- Bull trout require cool water temperatures.

Which of the following changes is **most likely** to occur as a result of a decreased wolf population?

A. A decreased number of elk
B. A decreased number of bull trout
C. An increased number of willow shrubs
D. An increased number of predators of wolves

Information About Malaria

- Malaria, a serious disease, is caused by a parasite that is spread by the bite of an infected mosquito.
- People travelling in areas where there is a high risk of contracting malaria used to be prescribed chloroquine pills to prevent the disease.
- Now, other treatments are usually prescribed because chloroquine is no longer guaranteed to be effective.

The **most probable** reason that chloroquine is less effective than it used to be in preventing the onset of malaria is that

A. malaria parasites have developed a resistance to chloroquine
B. mosquitoes have developed a resistance to the malaria parasite
C. people have developed a resistance to chloroquine
D. people have developed a resistance to the malaria parasite

Statements About Different Species

Statement I	Passenger pigeons were overhunted.
Statement II	Grizzly bears are no longer found in Mexico.
Statement III	Panda bears rely mainly on one food source.
Statement IV	Northern cod stocks off the coast of Newfoundland have been reduced.

Which of the statements above describes a species that has undergone extirpation?

A. I
B. II
C. III
D. IV

Matter and Chemical Change Review!

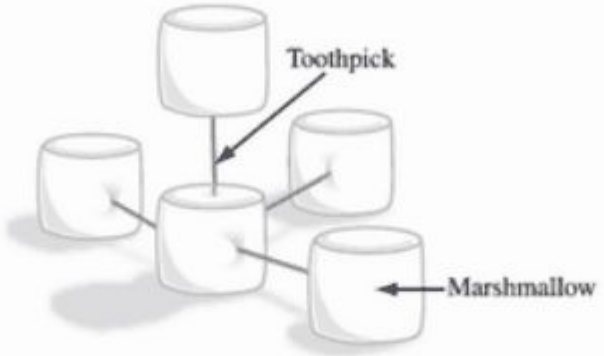
Main Concepts:

- Properties: Physical (Qualitative vs Quantitative) & Chemical
- Changes - Physical and Chemical (what are the indicators of each)
- Pure Substances vs Mixtures
- Atoms vs Ions
- Metals vs Nonmetals - know how to use your periodic table!
- Chemical Compounds - know your common ones (salt, methane, sugar, carbon dioxide)
- Molecular vs Ionic compounds - formation & composition (use periodic table), naming, properties & structure (incl. Law of Definite Composition)
- Chemical reactions - Law of Conservation of Mass, Reaction Rate, Endothermic vs Exothermic

PAT Sample Questions

Let’s look at some of the PAT SAMPLE QUESTIONS together

Tim created the following molecular model using toothpicks and marshmallows.



Which of the following chemical formulas could the model represent?

A. H_2
B. CH_4
C. H_2O
D. NH_3

A group of students conducts an experiment to determine the effect of temperature on reaction rates. They perform three separate trials in this experiment. In the first trial, they drop an antacid tablet into a beaker of water at a temperature of 40 °C and record how long it takes the tablet to completely dissolve. In the second and third trials, they use the same type and amount of antacid, but they change the temperature of the water to 25 °C for the second trial and 5 °C for the third trial.

The manipulated variable in this experiment is the

A. type of antacid used
B. amount of antacid used
C. time it takes for the reaction to occur
D. temperature at which the reaction occurs

Numerical Response

2. For each of the elements given below, indicate whether it is a metal or non-metal using the following code.

1 = Metal
2 = Non-metal

_____	_____	_____	_____
Aluminum	**Fluorine**	**Lithium**	**Phosphorus**

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Models of Different Molecules

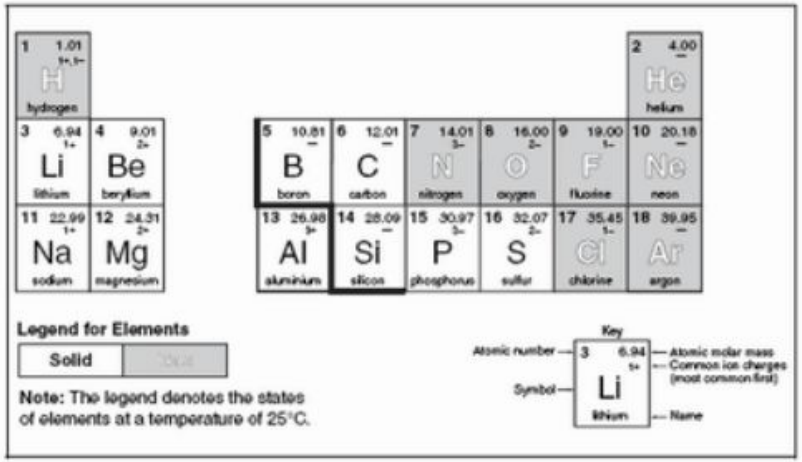
The chemical formula for the unknown molecule shown above is

A. P_2H_5OH
B. P_2H_5CH
C. C_2H_5OH
D. O_2H_5CH

When sodium and chlorine react, ___i___ compound is formed that ___ii___ conduct electricity when dissolved in water.

The statement above is completed by the information in row

Row	*i*	*ii*
A.	a molecular	will
B.	a molecular	will not
C.	an ionic	will
D.	an ionic	will not



Which of the following statements presents correct information about an element in the excerpt from the periodic table shown above?

A. Fluorine atoms can have 6 protons.
B. Carbon atoms can have 20 protons.
C. Sodium atoms can have 16 protons.
D. Phosphorus atoms can have 15 protons.

Which of the following elements is the least reactive?

A. Chlorine
B. Sodium
C. Argon
D. Boron

A Chemical Reaction

$$\underset{56\text{ grams}}{Fe_{(s)}} + \underset{?}{\underline{\quad ? \quad}} \rightarrow \underset{72\text{ grams}}{FeO_{(s)}}$$

The unknown reactant and its mass are

A. oxide and 16 g
B. oxide and 128 g
C. oxygen and 16 g
D. oxygen and 128 g

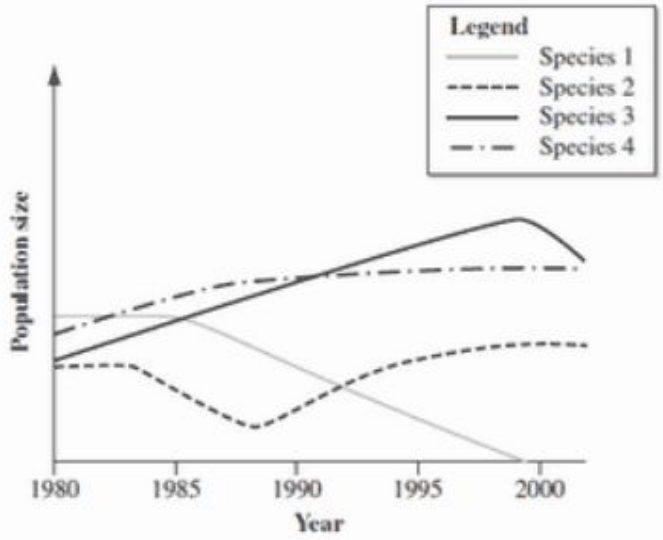
Environmental Chemistry Review

Main concepts:
- nutrients and substrates: organic (proteins, carbs, lipids) vs inorganic, fertilizers (NPK)
- Injestion vs absorption of materials
- Bioaccumulation vs Biomagnification
- Relationship between oxygen, nutrients (aka phosphates), organisms (including invertebrates)
- pH - how to measure, influences, causes of changes, how to neutralize
- Soil porosity
- Toxicity - acute vs chronic, LD50, ppm
- Bioremediation & Biodegredation
- Distribution, dilution, concentration

PAT Sample Questions

Let’s look at some of the PAT SAMPLE QUESTIONS together

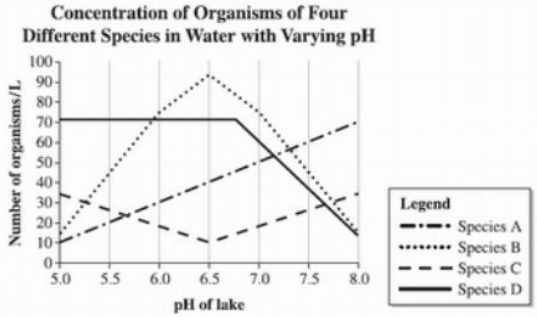
The graph below shows the population trends of four species between the years 1980 and 2002. Annual pesticide applications began in 1982.



Which of the following inferences is supported by the information in the graph above?

A. Species 1 became resistant to pesticide use.
B. Species 2 became resistant to pesticide use.
C. Species 3 was affected most by pesticide use.
D. Species 4 was affected most by pesticide use.

Many organisms are sensitive to changes in the pH of their environments. The graph below shows the concentrations of organisms of four different species as a function of the pH of a lake.



According to the information in the graph, which of the species is **most sensitive** to changes in the pH of the lake?

A. Species A
B. Species B
C. Species C
D. Species D

Which species has the **fewest** number of organisms present in lake water that has a neutral pH?

A. Species A
B. Species B
C. Species C
D. Species D

If acid rain falls into the lake and changes the pH of the water from 6.3 to 5.0, then the species that will increase in concentration is

A. species A
B. species B
C. species C
D. species D

Which of the following statements **best** defines the term LD_{50}?

A. LD_{50} is the proportion of the first 50 organisms in a test population that dies when exposed to a particular substance.

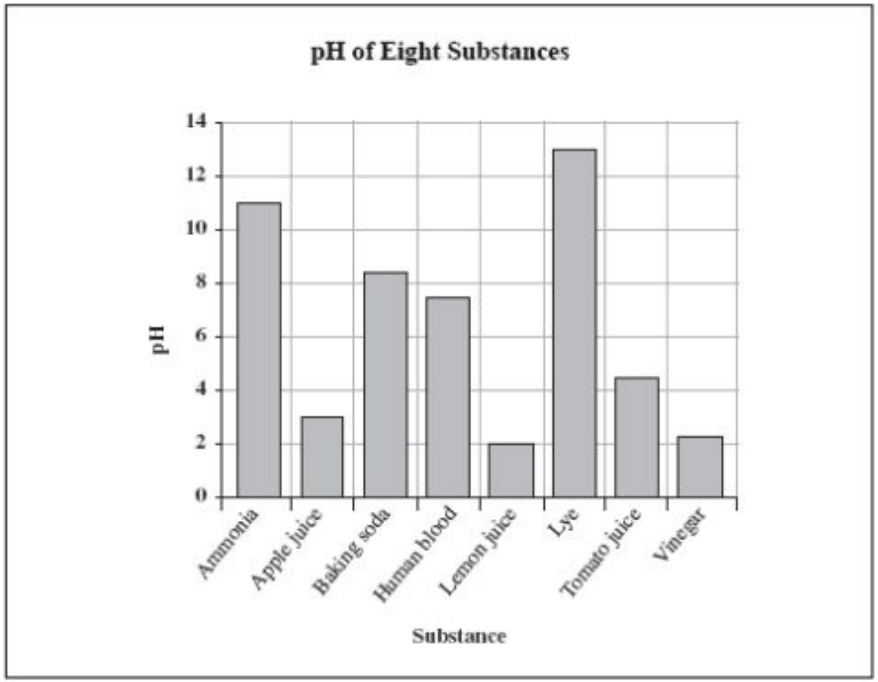
B. LD_{50} is the proportion of the first 50 organisms in a test population that becomes sick when exposed to a particular substance.

C. LD_{50} is the concentration of a substance administered to a test population that kills half the organisms in the test population.

D. LD_{50} is the concentration of a substance administered to a test population that makes half the organisms in the test population sick.

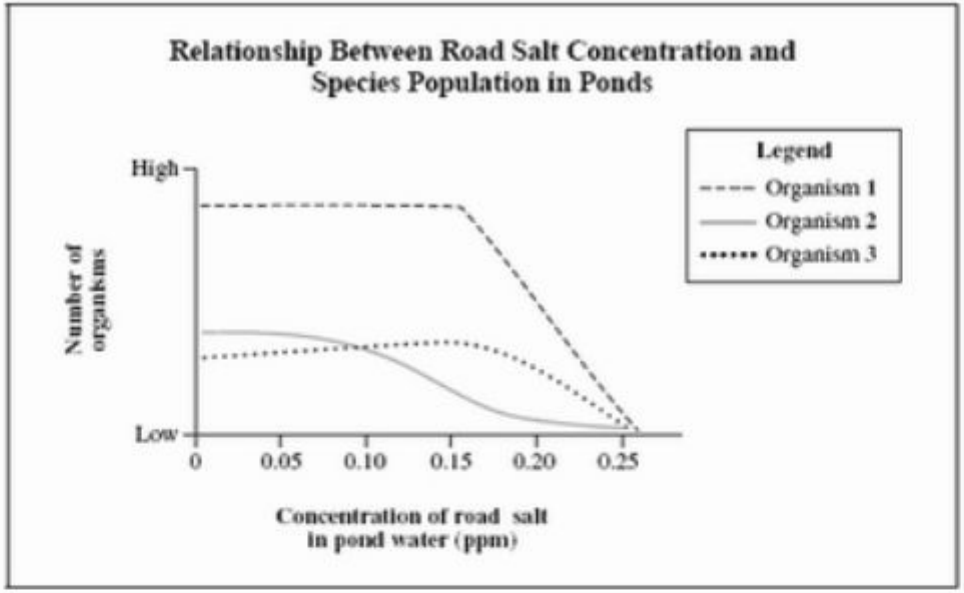
The process by which toxins are concentrated as they move up the food chain is called

A. pollution
B. biomagnification
C. web magnification
D. biomass stratification



Which of the following conclusions can be made from the graph above?

A. Vinegar is more basic than lye.
B. Ammonia is more acidic than apple juice.
C. Baking soda is more basic than human blood.
D. Tomato juice is more acidic than lemon juice.



According to the graph above, an increase in the concentration of road salt in pond water from zero to 0.10 ppm results in a decrease in the number of

A. organism 1
B. organism 2
C. organisms 1 and 3
D. organisms 2 and 3

Which of the following substances is inorganic?

A. Table salt
B. Peanut oil
C. Orange juice
D. Brown sugar

Electricity Review!

Main Concepts:

- Static vs Current Electricity (including insulators and conductors)
- Circuit Diagrams
- Series vs Parallel Circuits
- Voltage, Current & Resistance (including Ohm's Law & variable resistors)
- Power use & efficiency calculations
- Energy transformations - these are important!
- Motors and generators (components and function)
- Power in the home (include fuses and circuit breakers)
- Electrochemical cells - components, what affects strength
- Alternative energy

Description of a Circuit

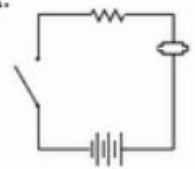
An electric pump is connected to a car battery. The speed of the pump is controlled by a dial.

Legend

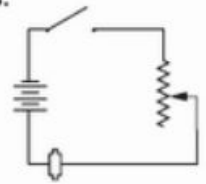
- Car battery
- Electric pump
- Resistor
- Variable resistor
- Ignition switch for car

Which of the following schematic diagrams **best** illustrates the circuit described above?

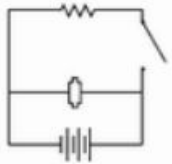
A.



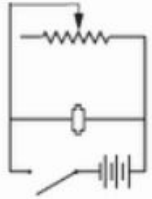
B.



C.



D.



Types of Power Generation

1 Coal-fired
2 Hydroelectric
3 Nuclear
4 Solar

Numerical Response

4. Match each type of power generation listed above with one of its disadvantages, given below.

Disrupts the movement of aquatic organisms _____
(Record in the **first** column)

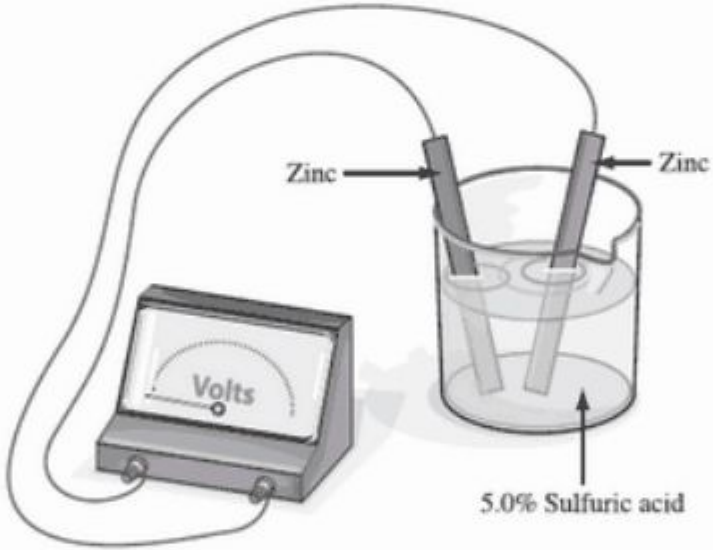
Emits carbon dioxide and sulfur dioxide into the air _____
(Record in the **second** column)

Is an inconsistent method of power generation _____
(Record in the **third** column)

Requires the long-term storage of hazardous waste products _____
(Record in the **fourth** column)

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

After assembling the wet cell shown below, Roger noticed that no electricity was produced.



Which change could Roger make to the wet cell to produce electricity?

A. Replace one of the zinc electrodes with copper.
B. Increase the sulfuric acid concentration to 7.5%.
C. Replace both of the zinc electrodes with copper.
D. Decrease the sulfuric acid concentration to 2.5%.

A student explains how electric circuits function by comparing them to a traffic model. Some of the components of traffic are listed below.

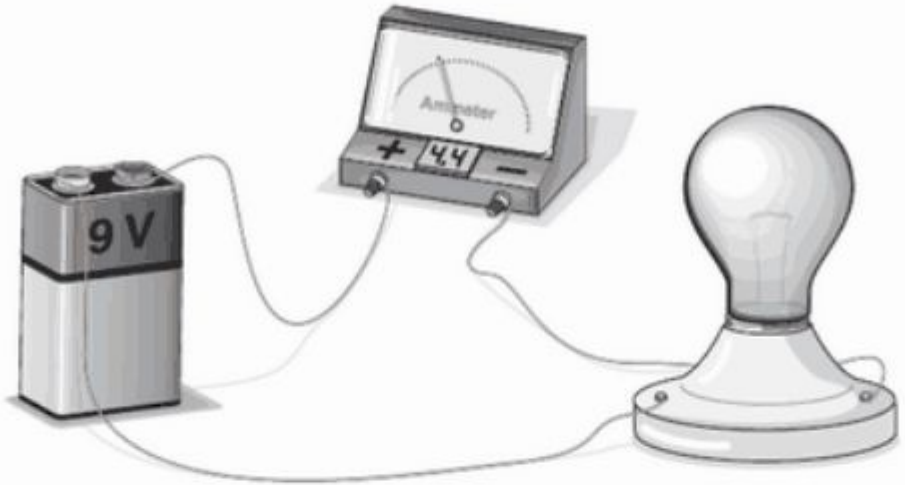
Traffic Components

I	Road construction sites
II	Stop signs
III	Vehicles
IV	Roads

Which component of the traffic model is **most closely** related to switches found in circuits?

A. I
B. II
C. III
D. IV

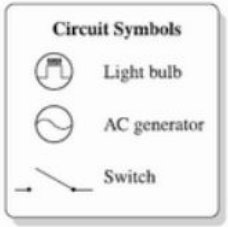
Jason builds a circuit as shown below.



To the nearest tenth of a watt, how much power does the bulb consume ($P = IV$)?

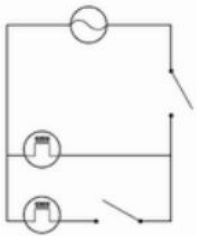
A. 0.5 W
B. 2.0 W
C. 13.4 W
D. 39.6 W

A garage is equipped with two lights and a generator, which are wired in parallel. Each light can be controlled separately, and there is a switch that can turn off both lights at once.

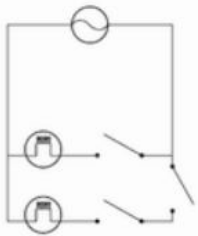


Which of the following diagrams represents the circuit described above?

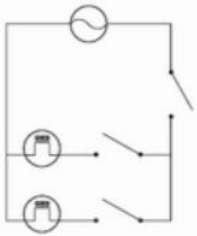
A.



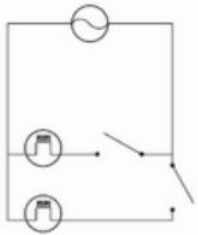
B.



C.



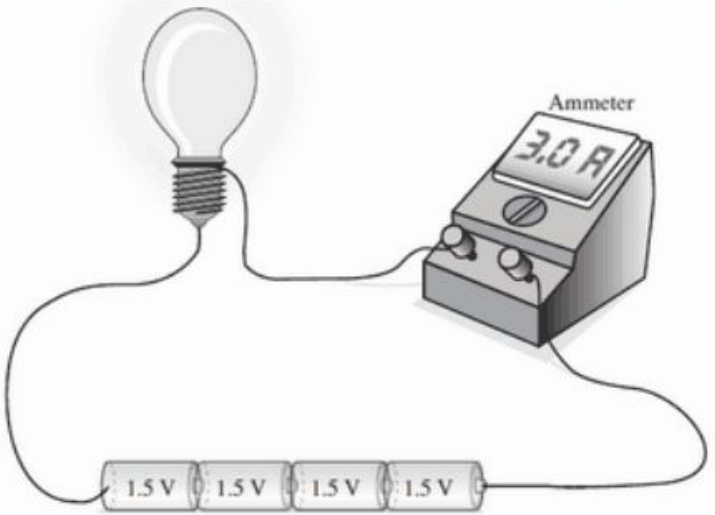
D.



Ohm's Law

$$R = \frac{V}{I}$$

R = resistance
V = voltage
I = current



The resistance in the circuit shown above is

A. 2 Ω
B. 3 Ω
C. 4 Ω
D. 6 Ω

Space Exploration Review

Main Concepts:
- Models of the universe - geocentric vs heliocentric
- Distribution of matter & the planets - characteristics of inner vs outer planets
- Telescopes (reflecting, refracting, radio and space)
- Azimuth and Altitude
- Spectroscopy
- Triangulation
- Rocketry
- Life support in space & problems in space
- Satellites - types, function and location
- Canadian contributions

Which of the following planets is considered to be terrestrial?

A. Saturn
B. Jupiter
C. Uranus
D. Mercury

The **best** baseline for triangulation to determine the distance between the unknown star and the sun shown above will be established when Earth is in positions W and

A. V
B. X
C. Y
D. Z

Parts of the Universe

1 Earth
2 Milky Way
3 Solar system
4 Sun

Numerical Response

5. List the parts of the universe given above in order from the part with the smallest diameter to the part with the largest diameter.

_____ _____ _____ _____

Smallest diameter **Largest diameter**

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Astronauts on the International Space Station recycle the water that they use, purify dirty water when necessary, and recover water from the humidity of the air within the station.

To manage their water requirements aboard the space station, astronauts do **not** need

A. processes to purify drinking water
B. containers to store large quantities of water
C. a system to recover moisture from inside the space station
D. solar panels to provide electrical power for the water recycling process

What is the student in the illustration above **most likely** trying to determine?

A. The altitude of the sphere
B. The azimuth of the sphere
C. The distance to the sphere
D. The diameter of the sphere

The chart that contrasts the geocentric model of the solar system with the current heliocentric model is

A.

Geocentric Model	Current Heliocentric Model
• Planets orbit the Sun	• Planets orbit Earth
• Orbits are circular in shape	• Orbits are elliptical in shape

B.

Geocentric Model	Current Heliocentric Model
• Planets orbit the Sun	• Planets orbit Earth
• Orbits are elliptical in shape	• Orbits are circular in shape

C.

Geocentric Model	Current Heliocentric Model
• Planets orbit Earth	• Planets orbit the Sun
• Orbits are circular in shape	• Orbits are elliptical in shape

D.

Geocentric Model	Current Heliocentric Model
• Planets orbit Earth	• Planets orbit the Sun
• Orbits are elliptical in shape	• Orbits are circular in shape

True and False Statements About Refracting Telescopes

Statement 1	Refracting telescopes use mirrors.
Statement 2	Refracting telescopes were the first type to be designed.
Statement 3	The image from a refracting telescope is not distorted by atmospheric interference.
Statement 4	A refracting telescope has an eyepiece and an objective lens.

Which of the statements above are **true**?

A. Statements 1 and 3
B. Statements 1 and 4
C. Statements 2 and 3
D. Statements 2 and 4