ST4 JUNE 2012 FINAL EXAM

Date: Tuesday, June 19, 2012 **Time:** 9:00 am – 12:00 pm **Room:** Group 01 (David's Group) Rm 215 Group 03 (Sabrina's Group) Rm 308

Compulsory Concepts Evaluated

NOTE: Please return your **textbook** and the **June 2011 exam**, so that you can get a ticket from me before you head to your exam. You will need the ticket to enter the exam room.

The Living World	The Material World	Earth and Space
EcoLogY - Study of populations (density, biological cycles) - Dynamics of communities • Biodiversity • Disturbances - Dynamics of ecosystems • Trophic relationships • Primary productivity • Material and energy flow • Chemical recycling	 PHYSICAL PROPERTIES OF SOLUTIONS Concentration (ppm) Electrolytes pH scale Electrolytic dissociation lons Electrical conductivity CHEMICAL CHANGES Combustion Photosynthesis and respiration Acid-base neutralization reaction Balancing chemical equations Law of conservation of mass ORGANIZATION OF MATTER Rutherford-Bohr atomic model Lewis notation ELECTRICITY AND ELECTROMAGNETISM ELECTRICITY Electrical charge Static electricity Ohm's law Electrical circuits Relationship between power and electrical energy ELECTROMAGNETISM Forces of attraction and repulsion Magnetic field of a live wire TRANSFORMATION OF ENERGY Law of conservation of energy Energy efficiency Distinction between 	Biogeochemical cycles - Carbon cycle - Nitrogen cycle CLIMATE ZONES - Factors that influence the distribution of biomes - Marine biomes - Terrestrial biomes - Terrestrial biomes LITHOSPHERE - Minerals - Soil profile (horizons) - Permafrost - Energy resources HYDROSPHERE - Catchment area - Oceanic circulation - Glacier and ice floe - Salinity - Energy resources Atmosphere - Greenhouse effect - Atmospheric circulation - Air mass - Cyclone and anticyclone - Energy resources SPACE - Solar energy flow - Earth-Moon system (gravitational effect)
	The Technological World	
MECHANICAL ENGINEERING - Characteristics of linking of mechanical parts - Guiding controls - Construction and characteristics of motion transmission systems (friction gears, pulleys and belt, gear assembly, sprocket wheels and chain, wheel and worm gear) - Speed changes - Construction and characteristics of motion transformation systems (screw gear system, cams, connecting rods, cranks, slides, rotating slider crank mechanisms, rack-and-pinion drive)	ELECTRICAL ENGINEERING – Power supply – Conduction, insulation and protection – Control – Transformation of energy (electricity and light, heat, vibration, magnetism)	MATERIALS - Constraints (deflection, shearing) - Characteristics of mechanical properties - Types and properties • Plastics (thermoplastics, thermosetting plastics) • Ceramics • Composites - Modification of properties

STRUCTURE OF EXAM:

Exam	Type of Question	Number of Questions	Marks per Question	Percentage of the Exam
Part A	Multiple Choice	15	4	60%
Part B	Constructed Response	6	4	24%
Part C	Technological Analysis	4	4	16%

WEIGHTING TABLE:

	The Living World	Earth and Space	The Material World	The Technological World
Weight	12% (3 questions)	20% (5 questions)	48% (12 questions)	20% (5 questions)

EXAM REVIEW QUESTIONS

- These questions do not cover all the topics we covered.
- Thanks to Mr. Uva, more exams and review questions can be found on the following website: <u>http://www.emsb.qc.ca/laurenhill/science/stexams.html</u>

MULTIPLE CHOICE:

1. Monica makes the following observations on an object:

	I- Volume: 12.0 II- Length: 12.0					
	III- Mass: 1.25 g					
	IV- Melting point:	450° C				
	Which observation is a <i>chara</i>	acteristic property?				
	A) I	B) II	C) III	D) IV		
2.	2. Which of the following properties indicates an object is a non metal ?					
	A) It is chrome in color	B) It is shinny	C) It is a good insulator	D) It is malleable		
3.	Which of the following are ph	ysical changes?				
	 Burning gasoline Crushing a rock Cutting grass Iron rusting Water evaporating 	I				
	A) 1,4	B) 1,4,5	C) 2,3	D) 2,3,5		
4.	Alison decomposes a sample	of matter into different substance	es. The original substance was	s not a/an:		
	A) compound	B) element	C) solution	D) mixture		
5. Which of the following does not represent a compound?						
	A) O ₂	B) H ₂ O	C) CO ₂	D) CH ₄		
6.	A certain gas extinguishes a in the gas. Which of the follo	candle flame immediately. It had wing could it be?	no effect on lime water and co	pper did not change when heated		
	A) Air	B) Nitrogen	C) Carbon dioxide	D) Oxygen		
7.	A chemical change must nec	essarily produce which of the foll	owing?			
	A) A mixture	B) A new substance	C) A solution	D) A change of state		
8.	What is the <i>mass number</i> of	an element that has 26 protons,	26 electrons, and 30 neutrons	?		
	A) 30	B) 52	C) 56	D) 82		
9.	Which of the following indicat	es that a chemical change is tak	ing place?			
	 A gas is released A precipitate is formed The mass is conserved (remains the same) A solute dissolves completely The color changes The number of atoms is conserved 					
	A) 2,3,4	B) 1,2,5	C) 1,4,6	D) 3,5,6		
10.	An ion is an atom that:					
	A) is electrically neutralB) has lost or gained one orC) has lost or gained one orD) has lost or gained one or	more protons				
11.	An atom consists of 23 protor	ns, 23 electrons and 28 neutrons.	What is its mass number?			

D) 51

C) 46

A) 23

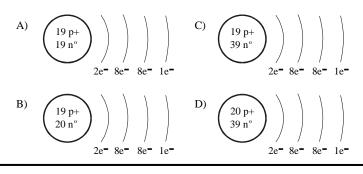
B) 28

12. Which of the following statements correctly describes Rutherford's model of the atom?

- A) made up of indivisible particles
 B) a sphere containing evenly distributed positive and negative charges
 C) a sphere in which the positive charges are concentrated in the nucleus with the negative charges outside the nucleus.
 D) A sphere containing evenly distributed positive and negative particles in the nucleus.

14.	 A) 23 The number of valence electric A) 1 To which family of the periodic 	B) 28	rons. What is its atomic number? C) 46 lithium is:	D) 51	
	The number of valence electr A) 1 To which family of the periodi	rons contained in an atom of	,	D) 51	
	A) 1 To which family of the periodi		lithium is:		
15	To which family of the periodi	B) 2	0) 0		
15			C) 3	D) 4	
15.		•			
	A) The inert gases	B) The halogens	C) The alkali metals	D) The alkaline-earth metals	
16.		esium is 12. How many proto	ons and valence electrons respect	tively does magnesium have?	
	A) 12 and 12	B) 12 and 0	C) 12 and 2	D) 2 and 12	
17.			n the second energy level (or she		
	A) 2	B) 8	C) 18	D) 32	
18.	The "Plum Pudding" model of	f the atom was first proposed	d by:		
	A) John Dalton	B) Niels Bohr	C) Ernest Rutherford	D) J.J. Thomson	
19.	In 1803, John Dalton, in an a and Proust, wrote the first ato			ses as well as the laws of Lavoiser	
	Which of the following statem	nents <i>does not</i> correspond w	vith Dalton's theory?		
	A) Matter is composed of sB) All atoms in an element		nes neutral, sometimes positively o	or negatively charged particles.	
	,	nct element are different. on occurs, the products obtai	ined result from a rearrangement	of the atoms of the reagents.	
20.	Rutherford modified the atom	ic model after doing experim	nents where alpha particles were c	lispersed by a sheet of gold foil.	
	Consider the following:				
		e number of protons equals the tons are concentrated in a si	he number of electrons. mall positive space at the center o	of the atom.	
	 Atoms consist mostly of empty space. Electrons are contained in a positive sphere made up of protons. 				
	5- Electrons move about in specific energy levels (or shells). Which of these statements are based on Rutherford's experiments?				
	A) 1 and 2	B) 1 and 4	C) 2 and 3	D) 3 and 5	
21.	Which of the following illustra	tes the formation of a compo	ound from its elements?		
	A) $O + O \longrightarrow C$	_			
	B) O + O O				
	C) OO + Energy _				
	D) OO + Energy _	,			
_					
22.	The "Plum Pudding" model of A) John Dalton	f the atom was first proposed B) Niels Bohr	d by: C) Ernest Rutherford	D) J.J. Thomson	
				2) 000 1101000	
23.	Which of the following names A) Helium - H	and symbols is <i>correctly</i> m B) Nitrogen - Ni	natched? C) Magnesium – Mg	D) Aluminum - Am	
			o, Magnesiani Mg		
24.	Which of the following substa A) Ceramic	nces is <i>nonmagnetic</i> ? B) Cobalt	C) Nickel	D) Iron	
		B) Cobait			
25.	Knowing that the mass numb a simplified model of a Lithiur		nd its atomic number is 3, which o	f the following diagrams represents	
	$ \begin{array}{ c c c c c c c } \hline A) & B) & B) & C) & C) & J \\ \hline & & & & & \\ \hline & & & & & \\ \hline & & & &$				

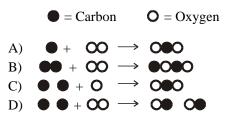
26. The atomic number of potassium, K, is 19 and its mass number is 39. Which of the following diagrams correctly represents the simplified atomic model (Rutherford-Bohr) of the potassium atom?



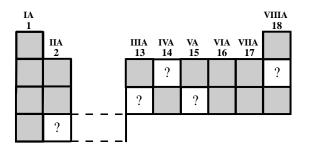
27. The incomplete combustion of carbon, C, in an environment containing little oxygen gas, O₂, produces a toxic gas called carbon monoxide, CO. This reaction is represented by the following equation:

$$2C + O_2 \rightarrow 2CO$$

Which of the following models correctly represents this reaction.



28. There are five unshaded boxes in the mini periodic table illustrated below.



Four of the five elements appear in these blank boxes as described below.

		First element:	Its third energy lev	el contains 5 valence electrons.	
		Second element:	It is a gas that does not react with metals or nonmetals.		
		Third element: of bones and teeth.	It is an alkaline earth metal and one of the components		
		Fourth element:	It is a light metal th	nat has 3 more electrons than an inert gas	š.
Wha	at is the fift	th element?			
A)	Calcium	(Ca)	B) Carbon (C)	C) Aluminum (Al)	D) Phosphorus (P)
The following items concern the structure of the Periodic Table of the Elements. Correctly match the terms in Column-I descriptions in Column-II.		h the terms in Column-I with the			
1	Columi . Atomic r		2)	Column-II indicates number of electron shells	
-		r Family of Elements	,	are the Halogens	
	•	f Elements	,	are relatively inactive	

- Inert (noble) Elements
 F, Cl, Br, I, and At

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c) are relatively inactive
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d) indicates the number of protonse) indicates the number of outermost electrons

C) 1e, 2a, 3e, 4b, 5c

A) 1a, 2b, 3c, 4d, 5e

Т 29. d

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D) 1a, 2d, 3e, 4c, 5b
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30. Karen observed and recorded the properties of a solid substance.

PROPERTY	OBSERVATION
Mass	8.90 g
Volume	1.13 cm ³
Magnetic	Yes
Conducts electricity	Yes

B) 1d, 2e, 3a, 4c, 5b

Given the observations in the table above and the information in the table below, identify the substance Karen observed.

Substance	Density	Conducts electricity	Magnetic	
Cobalt, Co	8.90 g/cm ³	Yes	Yes	
Copper, Cu	8.95 g/cm ³	Yes	No	
Iron, Fe	7.87 g/cm ³	Yes	Yes	
Sulfur, S	2.07 g/cm ³	No	No	

A) Cobalt

C) Copper

31.	Alkali metals form Family-I of the periodic table of elements. In increasing order of mass, they include lithium, sodium,
	potassium, rubidium, cesium, and francium. These six elements are grouped in the same family by reason of the similarity of
	their chemical properties.

Which of the following statements explains this similarity in chemical properties?

- Each of these elements possesses the greatest atomic radius of its period. A)
- These six elements all possess the same electronic configuration. B) These six elements all possess only one electron in their outer energy level.
- C) D) These six elements all possess an odd number of electrons.

32. As part of a laboratory experiment, you are provided with the following eight solutions:

K₂O, LiOH, Al₂(SO₄)₃, KNO₃, H₃PO₄, Fe(OH)₃, HCIO, H₂Cr₂O₇

You are asked to classify these solutions in three groups based on their effect on neutral litmus paper. Which of the solutions would turn litmus paper red?

A) K_2O , KNO_3 , H_3PO_4 , HclO B) LiOH, Fe(OH)₃ C) H₃PO₄, HClO, H₂Cr₂O₇ D) K₂O, KNO₃, HCIO, H₂Cr₂O₇

33. The process of breaking a compound into its elements is called:

	A) synthesis	B) analysis	C) hydrolysis	D) distillation
34.	Beverly needs to prepare 300 mL	of a 30 g/L aqueous solution of	potassium chloride. What mas	s of solute will she need?

A) 9 g	B) 10 g	C) 100 g	D) 9 000 g	

35. The following table lists the characteristics of a certain liquid.

CHARACTERISTICS			
Produces a gas when in contact with a piece of metal.			
Conducts electricity.			
Turns litmus paper red.			

How would you describe this liquid?

- The liquid is a neutral solution. A)
- B) The liquid is an acidic solution.
- Ć) The liquid is a basic solution. D) The liquid is a neutral salt solution.

36. The four conductors shown below are made out of copper. Which one has the greatest conductance

	A)		0		
	В)		D		
	C)		D		
	D)			D	
37.	Which pair of su	ubstances can l	be used as conductors is an ele	ectric circuit?	
	A) Aluminum a	nd copper	B) Copper and glass	C) Porcelain and glass	D) Aluminum and porcelain
38.	A manufacturer be used for this		ate an electric wire with a non-c	onducting material. Which one	of the following materials <i>cannot</i>
	A) Ceramic		B) Graphite	C) Plastic	D) Glass
39.	In every neutral	l atom, the num	ber of electrons is:		
	A) less that	an the number	of neutrons		
	B) equal t	o the number o	of neutrons		
	C) greater	r than the numb	per of protons		
	D) equal t	o the number c	of protons		
40.	Which of the fel	louing proporti	as of stainloss staal avalain wh	y stainless steel pots may be u	

1-Not easily distorted Average conductor of electricity 2-2 3-4-5-Good conductor of heat Does not corrode High density 6-High melting point 5 and 6

41.	Which of the following substances are conductors?					
	1-Rubber	2-Plastic	3-Aluminum	4-Copper	5-Steel	
	A) 1 and 2		B) 1 and	3	C) 2, 4 and 5	D) 3, 4 and 5

42. There are three simple ways to charge an object electrically: by rubbing, by direct contact and by induction. Which of the following statements are true?

1. It is very easy to charge a conductor by contact.

2. By rubbing, glass picks up electrons from silk and becomes positively charged.

3. An object charged by induction remains electrically neutral overall. 4.

In a clothes drier, the clothes can become charged by contact.

43. Which of the following is TRUE concerning a series circuit?

- - -	The current through each element (resistor) is the same. The voltage drop across each element (resistor) is the same The sum of the voltage drops equals the power source voltage.				
A) I	B) II	C) III	D) I and II	E) I and III	

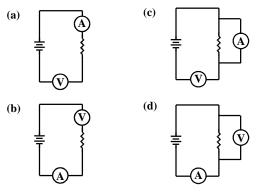
44. Which of the following is **TRUE** concerning a *parallel* circuit?

- - - V-	Adding a resistor in Adding a resistor in	parallel decreases to parallel increases the		
A) I and II	B) I and IV	C) II and IV	D) I, II and IV	E) I, III and IV

45. What must be the value of a resistor so that when connected in *parallel* with a 12 Ω resistor it produces a total resistance of 3 Ω ?

Α) 1 Ω	B) 2Ω	C) 3 Ω	D) 4 Ω	E) 6Ω	

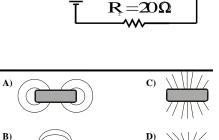
46. Which of the following diagrams is correct?



47.		nat are the potential difference across		<u>10 Ω</u>	15 Ω	_
	the 15 Ω and 25 Ω resis	stors respectively?				
	A) 00		110 v 🛓			$(A_1) I_1 = 2 A$
	A) 20 v and 30 v	B) 10 v and 50 v	1			Ť
	C) 30 v and 50 v	D) 20 v and 50		25 Ω	5Ω	
	E) 30 v and 10			•••		

48. The following electric circuit consists of two resistors (R1 and R2) and a power source. What is the equivalent (or total) resistance of the circuit?

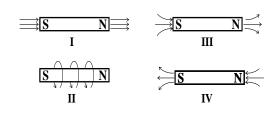
A)	0.1 Ω	C)	20 Ω
B)	10 Ω	D)	40 Ω



 $R = 20 \Omega$

w

50. Which of the following diagrams represents the magnetic lines



produced by a bar magnet?

49. Marc wants to draw a sketch representing the magnetic field he observed around a current-carrying solenoid he used in the laboratory. Which sketch is *correct*?



51.	Using the given symbols for the hydrogen, oxygen and carbon atoms, draw the molecule of each substance below.	() Hydroge	en O Oxygen	Carbon
		Water	Hydrogen gas	Oxygen gas
		water		Oxygen gus
		Carbon dioxide	Carbon tetrahydride (methane gas)	Carbon monoxide
52.	Draw a ball and stick model of the following equation	n.		
	a) $2H_2O \rightarrow 2H_2 + O_2$			
	b) Ba(OH) ₂ + 2 HCI \rightarrow BaCl ₂ + H ₂ O			
53	Why are the columns in the periodic call families? _			
55.				
54.	Identify the family with the following characteristic an	nd state their column nur	nber. (3 marks)	
	a) Doesn't react with anything.		column #	
	 b) Can be used to form acids and salts c) Is extremely reactive with water 		column # column #	
	 d) Is a powerful disinfectant 		column #	
55.	Classify the following changes as <i>physical</i> or <i>chen</i>	nical:		
	a) digestion of food			
	b) oxidation			
	c) growth of a plant			
	d) melting of icee) neutralization			
	e) neutralizationf) healing of a wound			
	g) drying of paint			
	h) dissolving of sugar			
	i) baking of bread			
	j) formation of dewk) fermentation of wine			
	l) boiling of water			
56.	State the number of each different types of atoms in	-	mpounds.	
	a) NH ₄ OH N H			
		C O		
	c) CH ₃ COOH C H d) (NH ₄) ₂ C ₂ O ₄ N H	C O		
	G) (NH4)2O2O4 N H	00		
57.	Balance the following chemical equations and name	e the type of reaction.		
	Equation		Type of reaction	
	$1. Fe_{(s)} + O_{2(g)} \rightarrow Fe_2O_{3(s)}$			
	2. $H_2O_{(l)} \rightarrow H_{2(g)} + O_{2(g)}$			
	3. $KOH_{(s)}$ + $H_2SO_{4(aq)} \rightarrow K_2SO_{4(aq)}$ + $H_2O_{(l)}$			
	4. $CuSO_{4(i)}$ + $NaOH_{(i)} \rightarrow Cu(OH)_{2(ppt)}$ + I	Na ₂ SO _{4(s)}		

58. a) Write the balance equation for cellular respiration.

- 59. Three simple classifications of chemical reactions are:

The following illustrations represent the three reactions listed above; classify them:

A	•• 00 00	\rightarrow		
B	• •	\rightarrow	¢	
C	•%	\rightarrow		

60. When 191 g of copper, Cu, is combined with 756 g of nitric acid, HNO₃, the chemical reaction produces 563 g of copper nitrate, Cu(NO₃)₂, 108 g of water, H₂O, and a certain amount of nitrogen dioxide, NO₂. This reaction is represented by the following balanced chemical equation:

 $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$

a) What mass of nitrogen dioxide does this reaction produce?

b) What is the ratio of the reactants used?

- 61. Anna Banana needs to neutralize a window-cleaner that contains ammonia. When she tests it with red litmus paper, the paper turns blue.
 - a) What type of substance must she use to neutralize the cleaner? ____
 - b) What will 2 compounds will be produced after she neutralizes it? _____
- 62. In the laboratory, you are to neutralize an acid solution before disposing of it. Explain in detail how you would neutralize this solution. In you explanation, indicate the **material used and the steps involved.**

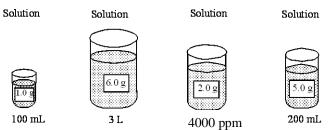
63. What are electrolytes? ____

- 64. How many electrons do the following ions have:
- 65. Are the following acids, bases, salts or neither? If they are electrolytes, what is there ionic dissociation? Ionic Dissociation

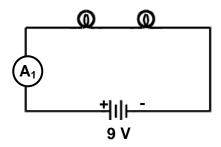
Ca²⁺_____ C⁻⁴_____ O⁻²_____ K⁺¹____

a)	HBr	
b)	H ₂ O	
	HCI	
d)	CaCl ₂	
e)	NaOH	

- 66. Convert the following concentration into ppm.
 - a) —
 - b) —
 - c) ——
 - d) —
- 67. List the following solutions below from least to most concentrated.

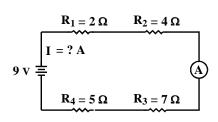


68. Draw the direction of an electron current and a conventional current.



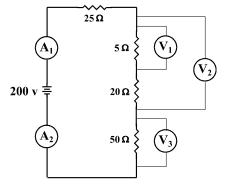
69. What are the 4 factors that influences the conductivity of a material? _

70. The circuit on the right consists of 4resistors whose values are 2 Ω , 4 Ω , 7 Ω and 5 Ω respectively. Calculate the reading of the ammeter.



- 71. A 6 Ω resistor, an 18 Ω resistor and a 9 Ω resistor are connected in parallel and placed across a 36 V battery. What is the *total resistance* and *total current* of the circuit?
- 72. For the circuit below, state the readings of each meter (be sure to include the unit).





- 73. The circuit is composed of a 6.0-V battery connected to a 10-Ω resistor. It includes an ammeter and a voltmeter connected to the resistor terminals. How much energy will the resistor release in one minute's work?
- 74. At the hottest setting, a blow dryer uses 90 000 J in 60 seconds. What is its power rating?
- 75. A 1000 W heater is turned on for 4 hours. How much energy is used?

76. What type of energy are the following objects associated with? (

 a) Solar panel ______
 d) Hydroelectric Dams ______

 b) Eating food _______
 e) Batteries _______

 c) Atoms _______
 f) Windmill _______

77. A car consumed 2000 kJ of energy.

- a) If its efficiency is only 15%, how much energy is actually used to move the car? Show all your work.
- b) If the car consumes triples the amount of energy, how much energy is actually used to move the car? Show all your work.

79. A student conducted an experiment involving three electrically charged spheres A, B and C. The steps in the experiment and some of the results are given below.

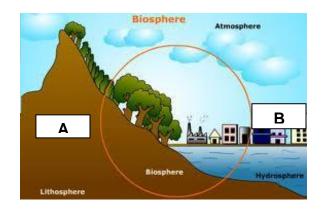
STEP	RESULT
1. Bring sphere A close to sphere B.	1. They attracted each other.
2. Bring sphere A close to sphere C.	2. They repelled each other.
3. Bring sphere B close to sphere C.	3. ?

Given the above information, what was the result of Step 3?

80. A balloon rubbed against human hair becomes negatively charged with static electricity.

Draw 3 diagrams and use (+) and (-) signs to show the electric charges and arrows to show any transfer of charges. Explain each of the three steps.

- 81. Spheres 1, 2, 3 and 4 are electrically charged. The charge on sphere 1 is positive and the charge on sphere 4 is negative. We do not know the type of charge on spheres 2 and 3. What type of charge is on sphere 2 and on sphere 3?
 What type of charge is on sphere 2 and on sphere 3?
 When spheres 1 and 2 are brought near each other, they attract.
- 82. Which part of the Earth is represented by the following letters in the picture below?

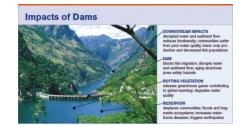


83. What type of energy resource is associated with the following pictures? Explain how you know. Where does the energy resource come from?

B)







- 84. What are the 3 types of rocks? Give an example of each one and state its use.
- 85. What are the 3 conditions necessary for soil to support plant life?
- 86. What type of chemical reaction is the combustion of fossil fuels? Write the chemical equation for it.
- 87. Water can be carried from the equator to the North Pole. Why?
- 88. What are the 2 reasons that cause ocean water to move?