# SCIENCE

## FORMULA CHART for Grade 10 Science Assessment

$Density = \frac{mass}{volume}$	$D = \frac{m}{v}$
$\begin{pmatrix} \text{heat gained or} \\ \text{lost by water} \end{pmatrix} = \begin{pmatrix} \text{mass in} \\ \text{grams} \end{pmatrix} \begin{pmatrix} \text{change in} \\ \text{temperature} \end{pmatrix} \begin{pmatrix} \text{specific} \\ \text{heat} \end{pmatrix}$	$Q = (m)(\Delta T)(C_p)$
$Speed = \frac{distance}{time}$	$s = \frac{d}{t}$
$Acceleration = \frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$	$a = \frac{v_{\rm f} - v_{\rm i}}{\Delta t}$
$Momentum = mass \times velocity$	p = mv
Force = $mass \times acceleration$	F = ma
$Work = force \times distance$	W = Fd
$Power = \frac{work}{time}$	$P = \frac{W}{t}$
$\%$ efficiency = $\frac{\text{work output}}{\text{work input}} \times 100$	$\% = \frac{W_{\rm O}}{W_{\rm I}} \times 100$
Kinetic energy = $\frac{1}{2}$ (mass × velocity $^2$ )	$KE = \frac{mv^2}{2}$
$Gravitational\ potential\ energy = mass \times acceleration\ due\ to\ gravity \times height$	GPE = mgh
Energy = mass $\times$ (speed of light) <sup>2</sup>	$E = mc^2$
Velocity of a wave = frequency $\times$ wavelength	$v = f\lambda$
voltage	$I = \frac{V}{R}$
$Current = \frac{voltage}{resistance}$	$I = \overline{R}$
$Current = \frac{\text{voltage}}{\text{resistance}}$ $Electrical power = voltage \times current$	$I = \frac{1}{R}$ $P = VI$

Constants/Conversions							
g = accele	$g$ = acceleration due to gravity = 9.8 m/s $^2$						
c = s	speed of light = $3 \times 10^8$ r	n/s					
speed	d of sound = 343 m/s at 2	20°C					
	$1 \text{ cm}^3 = 1 \text{ mL}$						
1 v	1 wave/second = 1 hertz (Hz)						
1	calorie (cal) = 4.18 joule	S					
1000 calories (ca	l) = 1 Calorie (Cal) = 1 k	rilocalorie (kcal)					
	newton (N) = $kgm/s^2$						
	joule (J) = Nm						
	watt $(W) = J/s = Nm/s$						
volt (V)	ampere (A)	ohm (Ω)					

	18 VIIIA	<b>F</b> 2	4.0026 Helium	<b>S</b> 10	20.179 Neon	18	<b>A</b> f 39.948 Argon	9,	<u>۔</u>	83.80	4	×e	131.29 Xenon	98	E E	(222) Radon				71		174.967 Lutetium	103		(262) Lawrencium
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			16 VIA	∞ 0	15.999 Oxygen	16	32.066 Sulfur	34	Se	78.96 Selenium	52	<u>е</u>	127.60 Tellurium	84	Po	(209) Polonium				69	E	168.934 Thulium	101	βq	(258) Mendelevium
		Φ	15 VA	<b>⊳ Z</b>	14.007 Nitrogen	51 C	30.974	33	As	74.922	51	Sb	121.763 Antimony	83	Ö	208.980 Bismuth				89	ш	167.26 Erbium	100	Fn	(257) Fermium
		Name	14 IVA	ဖ ပ	12.011 Carbon	4 <b>0</b>	28.086 Silicon	32	Ge	72.61 Germanium	50	S	118.71 Tin	82	요	207.2 Lead	re those of	isotope.		29	운	164.930 Holmium	66	Es	(252) Einsteinium
41-	<b>S</b> 28.086	Silicon —	13 IIIA	ഹ മ	10.81 Boron	13	<b>A</b> 26.982 Aluminum	31	Ga	69.72	49	占	114.82 Indium	81	F	204.383 Thallium	Mass numbers in parentheses are those of	the most stable or most common isotope.		99	ò	162.50 Dysprosium	86	ర	(251) Californium
							12 IIB	30	Zu	65.39 Zinc	48	ප	112.41 Cadmium	80	Нg	200.59 Mercury	mbers in pa	t stable or m		92	<b>P</b>	158.925 Terbium	26	番	(247) Berkelium
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Ato	*						10	28	Z	58.69 Nickel	46	Pd	106.42 Palladium	28	풉	195.08 Platinum	110	(269)		63	П	151.97 Europium	92	Am	(243) Americium
[ <sub>6</sub> ]							6 IIIA	27	ပိ	58.933	45	R	102.906 Rhodium	2.7	i	192.22 Iridium	109 <b>M</b>	(266) Meitnerium		62	Sm	150.36 Samarium	94	Pn	(244) Plutonium
Elements							ထ	26	æ	55.847		æ	101.07 Ruthenium	9/	s <sub>O</sub>	190.23 Osmium	108 <b>H</b>	(265) Hassium		61	Pm	(145) Promethium		8 P	237.048 Neptupium
							7 VIIB	25	M	54.938 Mangapasa	43	ဥ	95.94 (98) Molybdenum Technetium	75	Be	186.207 Rhenium	107 <b>2</b>	(262) Bohrium		09	ğ	140.908 144.24 Praseodymium Neodymium	95	<b>-</b>	238.029
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		-			V		က		4			7.			9			7	-						

### **DIRECTIONS**

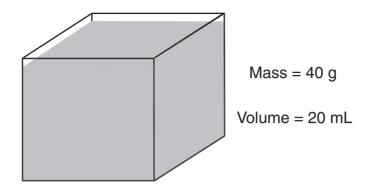
Read each question and choose the best answer. Then fill in the correct answer on your answer document.

#### **SAMPLE A**

When a 10% hydrochloric acid solution is heated in an open test tube, the test tube should always be pointed —

- A so bubbles are visible
- **B** at a 180° angle from the flame
- C toward a ventilated area
- **D** away from nearby people

#### SAMPLE B

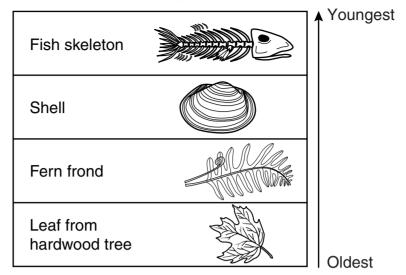


The picture shows a cube that contains 20~mL of a solution. The solution has a mass of 40~grams. What is the density in g/mL of this solution? Record and bubble in your answer on the answer document.

- 1 Dogs (*Canis familiaris*) are most closely related genetically to which of the following organisms?
  - **A** African hunting dog (*Lycaon pictus*)
  - ${\bf B} \quad {\rm Gray \ wolf \ } (Can is \ lupus)$
  - C Grizzly bear (*Ursus arctos*)
  - ${f D}$  Domestic cat (Felis catus)

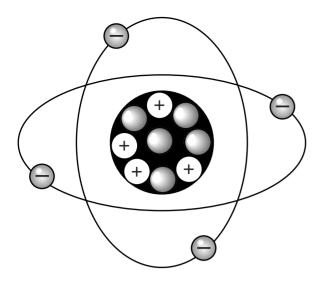
- 2 The primary way liquids and gases transmit heat is by the process of
  - F reflection
  - G conduction
  - H radiation
  - J convection

## Fossil Layers



- 3 During a severe drought a dry lake was explored for fossils. The diagram represents the fossils uncovered and the layers they were in. According to this information, this area was once a
  - A forest that was replaced by a freshwater lake
  - B freshwater lake that was replaced by a desert
  - C saltwater sea that was replaced by a forest
  - **D** freshwater lake that was replaced by a forest

- 4 A laboratory investigation included examining prepared slides of pond water. Single-celled organisms with a nucleus and either cilia or flagella were visible. These organisms probably belong to the kingdom
  - F Animalia
  - G Fungi
  - H Plantae
  - J Protista



- 5 The picture shows a model of the element
  - A fluorine
  - B helium
  - C beryllium
  - D oxygen

- **6** Which of these is a hypothesis that can be tested through experimentation?
  - **F** Bacterial growth increases exponentially as temperature increases.
  - **G** A fish's ability to taste food is affected by the clarity of aquarium water.
  - **H** Tadpoles' fear of carnivorous insect larvae increases as the tadpoles age.
  - **J** The number of times a dog wags its tail indicates how content the dog is.

7 Which of the following shows the length of a rubber strip measured precisely to 2.22 centimeters?







D

- 8 How much force is needed to accelerate a 1,300 kg car at a rate of 1.5 m/s<sup>2</sup>?
  - **F** 867 N
  - G 1,950 N
  - **H** 8,493 N
  - **J** 16,562 N

Use the information below and your knowledge of science to answer questions 9-11.

### **Photosynthesis**

$$\begin{array}{c} \text{light} \\ \text{energy} \\ 6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \end{array}$$

### Respiration

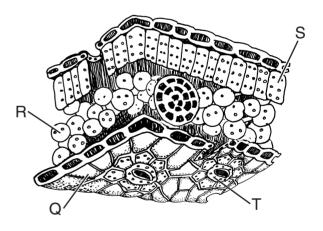
$$C_6H_{12}O_6 + 6O_2 \rightarrow energy + 6CO_2 + 6H_2O$$

The first equation represents photosynthesis. Plants use energy from sunlight to produce sugar and oxygen from carbon dioxide and water. The second equation represents aerobic respiration. Plants and animals release stored energy in a reaction between sugar molecules and oxygen. This reaction produces carbon dioxide and water.

- 9 Oxygen  $(O_2)$  is an example of
  - A an alloy
  - B a molecule
  - C a salt
  - D a mixture

- 10 To produce 4 molecules of sugar, a plant needs
  - F 6 molecules of hydrogen
  - G 12 molecules of ATP
  - H 18 molecules of water
  - J 24 molecules of carbon dioxide

### Cross Section of a Leaf



- Which structure regulates gas exchange during the processes of photosynthesis and respiration?
  - $\mathbf{A}$  Q
  - $\mathbf{B}$  R
  - C S
  - $\mathbf{D}$  T

## Most Abundant Elements at Earth's Surface

Element	Percent by Mass
Oxygen	46.6
Silicon	27.7
Aluminum	8.13
Iron	5.00
Calcium	3.63

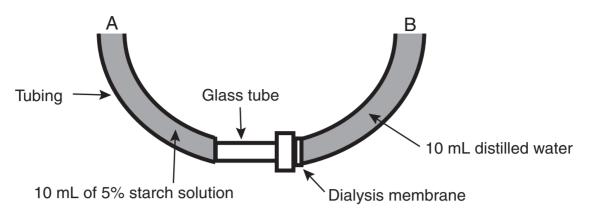
- **12** Which conclusion is best supported by these data?
  - **F** Earth's surface is composed mostly of silicon and calcium.
  - **G** Oxygen is closer to Earth's surface than aluminum.
  - **H** There is more aluminum than calcium at Earth's surface.
  - **J** Silicon is much heavier than iron at Earth's surface.

Toy Car Speed

Trial	Time (s)
1	5
2	7
3	4
4	7

- 13 The table shows times required for the same toy car to travel 10 m across an identical section of a floor after it is pushed. The difference in times was probably caused by differences in
  - A force exerted
  - B surface friction
  - C air resistance
  - D car mass

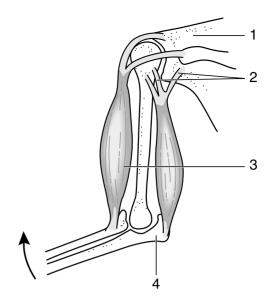
## Osmosis Apparatus



- 14 Which would most likely cause the liquid in Tube A to rise?
  - F Starch concentrations being equal on each side of the membrane
  - G Water passing from a region of lower starch concentration to one of higher starch concentration
  - **H** Water and starch volumes being the same
  - **J** Solute in the tubes changing from a higher temperature to a lower temperature

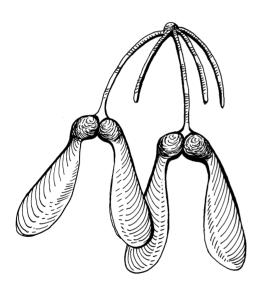
- 15 The reason for wafting or fanning a small amount of chemical vapors toward the nose as a means to detect odors in a test tube is to
  - **A** avoid experimental error from excessive loss of mass of reactants or products
  - **B** avoid splashing chemicals into the face of any person
  - C protect the respiratory tract against potentially harmful vapors
  - **D** determine the relative strength of the odor before smelling directly

- Pain medications can be made as powders or tablets. The powders tend to work faster than tablets with the same ingredients because powder —
  - **F** dissolves faster in solution than a single tablet
  - **G** has more total mass than a single tablet
  - H travels through the bloodstream more easily than a tablet
  - **J** is easier to swallow than tablets



- 17 Which structure in the upper arm is responsible for raising the lower arm?
  - **A** 1
  - **B** 2
  - **C** 3
  - **D** 4

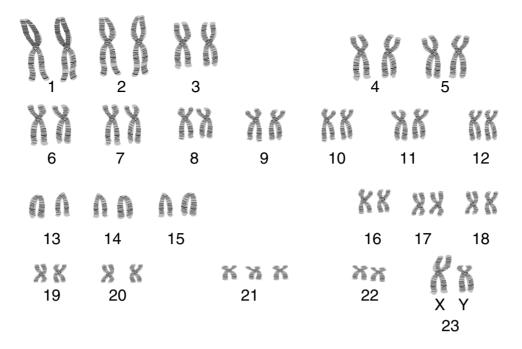
- 18 All of the following symptoms are likely associated with bacterial infection except
  - **F** skin rashes or lesions
  - G elevated body temperature
  - H swollen glands or tissues
  - J increased red blood cell count



- 19 This seed is best dispersed by
  - A water
  - **B** birds
  - C wind
  - **D** insects

20 A car traveled 150 km in 2.5 hours. What was its average speed in km per hour? Record and bubble in your answer on the answer document.

- 21 Which of the following will allow measurement of a liquid's volume with the greatest precision?
  - $\begin{array}{cc} \textbf{A} & 50 \text{ mL cylinder graduated in 1 mL} \\ & \text{increments} \end{array}$
  - $\begin{array}{cc} \textbf{B} & 100 \text{ mL cylinder graduated in } 0.5 \text{ mL} \\ & \text{increments} \end{array}$
  - C 100 mL cylinder graduated in 1 mL increments
  - $\begin{array}{cc} \textbf{D} & 200 \text{ mL cylinder graduated in 5 mL} \\ & \text{increments} \end{array}$



- 22 The diagram represents the chromosomes of a person with a genetic disorder caused by nondisjunction, in which the chromosomes fail to separate properly. Which chromosome set displays nondisjunction?
  - **F** 2
  - **G** 8
  - **H** 21
  - **J** 23
- **23** Which organism lives in the human intestine and aids in the digestive process?
  - A The bacterium Escherichia coli
  - **B** The fungus *Trichophyton rubrum*
  - C The protozoan Entamoeba coli
  - **D** The algae Fucus vesiculosus
- **24** Which of the following is most likely to cause increases in a predator population?
  - F Fewer prey
  - **G** A reduction in competition
  - **H** More parasites
  - J A period of drought

- **25** The medulla, part of the brain stem, reacts quickly to increased levels of  $CO_2$  in the blood and stimulates a response from the
  - A excretory system
  - B immune system
  - C respiratory system
  - **D** integumentary system

### Codon Chart

#### Second Position

		U	С	Α	G		
		Phenylalanine	Serine	Tyrosine	Cysteine	U	
		Phenylalanine	Serine	Tyrosine	Cysteine	С	
	U	Leucine	Serine	Stop	Stop	Α	
		Leucine	Serine	Stop	Tryptophan	G	
		Leucine	Proline	Histidine	Arginine	U C A	
	С	Leucine	Proline	Histidine	Arginine		
First Position	O	Leucine	Proline	Glutamine	Arginine		
		Leucine	Proline	Glutamine	Arginine	G	Third Position
(5')		Isoleucine	Threonine	Asparagine	Serine	U	(3')
	Α	Isoleucine	Threonine	Asparagine	Serine	С	
		Isoleucine	Threonine	Lysine	Arginine	Α	
		Methionine	Threonine	Lysine	Arginine	G	
		Valine	Alanine	Aspartic acid	Glycine	U	
		Valine	Alanine	Aspartic acid	Glycine	С	
	G	Valine	Alanine	Glutamic acid	Glycine	Α	
		Valine	Alanine	Glutamic acid	Glycine	G	

## $^{5'}$ AGAUCGAGU $^{3'} \rightarrow ^{5'}$ A $^{C}$ AUCGAGU $^{3'}$

- 26 The chain above represents three codons. Which of the following changes would be expected in the amino acid chain if the mutation shown above occurred?
  - **F** The amino acid sequence would be shorter than expected.
  - **G** The identity of one amino acid would change.
  - **H** The amino acid sequence would remain unchanged.
  - **J** The identities of more than one amino acid would change.

- 27 Energy conversion within an animal cell would be severely limited by removal of the cell's
  - A mitochondria
  - B chloroplasts
  - C plastids
  - **D** lysosomes

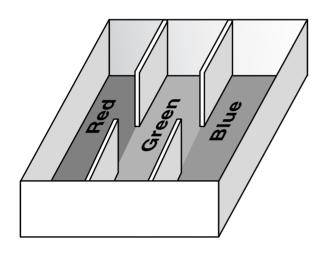
- 28 Ten different types of culture media were inoculated with the same strain of bacteria and incubated at the same temperature. Nine of the cultures grew. Which of these conclusions can be drawn from this information?
  - **F** The media used in the experiment are all capable of sustaining bacterial growth.
  - **G** The temperature varied greatly during the experiment.
  - **H** Only the culture that failed to grow bacteria was inoculated properly.
  - **J** One of the media lacked the nutrients needed for the bacteria to grow.

Ten frogs were placed in a large container with three sections. Each section had equal amounts of light, shelter, food, and water. Each section was painted a different color: red, green, or blue. Daily observations were made of the frogs' locations for six weeks. These data were compiled to produce the following frog location frequencies.

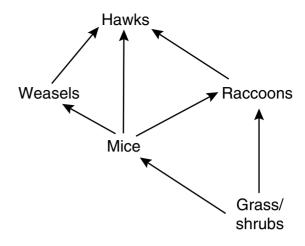
Red area = 31%

Green area = 35%

Blue area = 34%

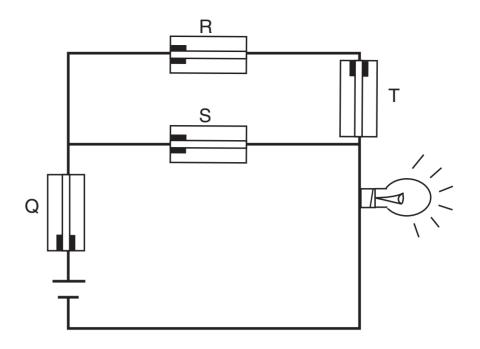


- **29** Which conclusion about the frogs is supported by these data?
  - **A** Four frogs out of ten preferred the green area.
  - **B** The frogs randomly moved into the colored areas.
  - **C** Most frogs tended to avoid the red area.
  - **D** Most frogs preferred the color blue.



- **30** Which organisms in this food web can be described as both primary and secondary consumers?
  - F Hawks
  - G Weasels
  - H Raccoons
  - J Mice

- 31 What is the density at 20°C of 12.0 milliliters of a liquid that has a mass of 4.05 grams?
  - **A** 0.338 g/mL
  - **B** 2.96 g/mL
  - C 16.1 g/mL
  - **D** 48.6 g/mL



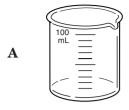
- **32** Which switch, if opened, will cause the lightbulb to stop glowing?
  - $\mathbf{F}$  Q
  - G R
  - H S
  - J T

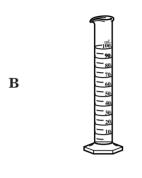
In Central America there is a tree called bullhorn acacia (*Acacia cornigera*) that provides both food and shelter to a certain species of ant (*Pseudomyrmex ferruginea*). The ants live within the tree without causing it harm. In fact, the ants protect the tree by vigorously attacking and stinging other animals that try to eat it.

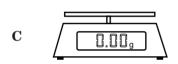
- 33 This relationship is an example of
  - A predation
  - B parasitism
  - C mutualism
  - **D** commensalism

- 34 The owner of a pet store assures a customer that if she buys only one female hamster, she will not need to worry about the hamster having offspring, because there will be no male with which the female can breed. What possibility is the pet-store owner overlooking?
  - **F** The hamster could be infertile.
  - **G** The sex of the hamster could change.
  - **H** The hamster could be pregnant.
  - **J** The hamster could be a twin.

**35** Which of the following pieces of equipment would be most appropriate for measuring the volume of a marble?







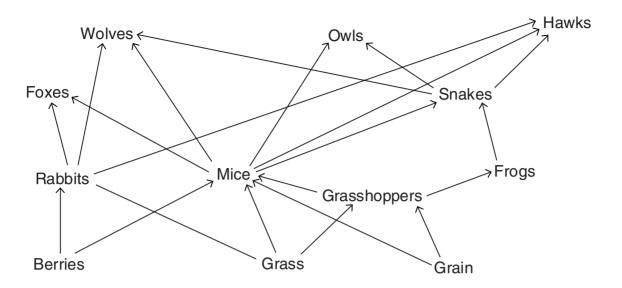


- 36 In the rock cycle, which of these is a chemical change involved with the formation of igneous rocks?
  - F Compression of sediments
  - G Heat loss from lava
  - H Subduction of plates
  - **J** Formation of minerals

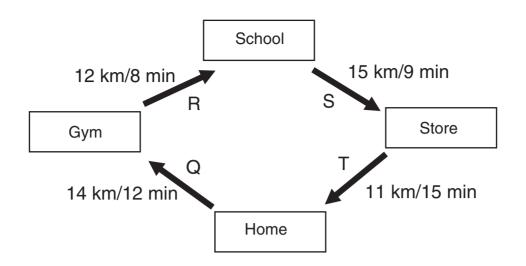
- 37 Multicellular eukaryotes that are usually mobile and obtain food from other organisms probably belong to the kingdom
  - A Plantae
  - B Fungi
  - C Animalia
  - **D** Protista

- 38 At 0°C sound travels through air at a speed of 330 m/s. If a sound wave is produced with a wavelength of 0.10 m, what is the wave's frequency?
  - **F** 0.0033 Hz
  - G 33 Hz
  - **H** 330 Hz
  - **J** 3300 Hz

## Common Food Web

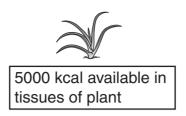


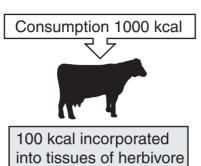
- 39 Wolves and hawks are at the same trophic level because they
  - A both live on land
  - $\boldsymbol{B} \quad \text{are both large mammals}$
  - C both eat primary consumers
  - **D** have similar hunting patterns

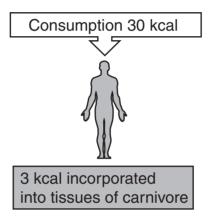


- **40** The diagram represents the total travel of a teacher on a Saturday. Which part of the trip is made at the greatest average speed?
  - $\mathbf{F}$  Q
  - G R
  - H S
  - J T
- 41 What characteristic of water remains the same no matter what is dissolved in it?
  - A The ratio of hydrogen to oxygen
  - **B** The ability to refract light
  - C The hydroxide ion concentration
  - **D** The freezing temperature

- **42** Which of these characteristics might help a plant species survive in an area with limited sunlight?
  - F Bright flowers
  - G Large leaves
  - H Short stems
  - J Thick cuticles







- **43** Approximately how much of the energy available in the tissues of the producer is eventually incorporated into the tissues of a secondary consumer?
  - A Less than 1%
  - **B** Between 20% and 30%
  - C Approximately 50%
  - **D** More than 50%

- 44 In an investigation 10,000 dung beetles were examined for the presence of parasites. The data showed that about 5% of the beetles had parasites. The results are
  - F invalid because only dung beetles were examined
  - **G** unsupported because the parasite population was small
  - H erroneous because more beetles should have had parasites
  - J valid because the sample size was sufficient for accuracy

$\square$ PbO <sub>2</sub> $\rightarrow$ $\square$ PbO + $\square$	0
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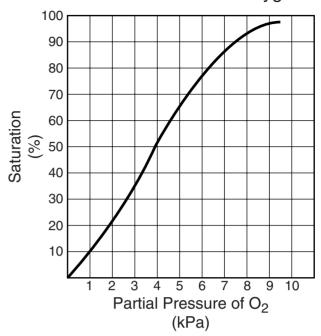
- **45** What are the coefficients that will balance this chemical equation?
  - **A** 2, 1, 1
  - **B** 3, 4, 2
  - **C** 2, 2, 1
  - **D** 4, 3, 2

- 46 What is the current in a copper wire that has a resistance of 2 ohms and is connected to a 9-volt electrical source?
  - **F** 0.22 amp
  - **G** 4.5 amps
  - **H** 11.0 amps
  - **J** 18.0 amps

- 47 Certain chemicals in the diet of moth larvae seem to influence the early development of the moths' wings. Careful observation of developing pupae could result in
  - **A** data to verify the hypothesis
  - **B** changes to the conclusion
  - C a conclusion about the moths' eggs
  - **D** development of a new moth species

- Which system is responsible for producing enzymes that aid in breaking down substances to be absorbed for the body's growth and repair?
  - F Digestive system
  - G Reproductive system
  - H Respiratory system
  - J Skeletal system

# Hemoglobin Saturation vs. Partial Pressure of Oxygen



- 49 According to the graph, about how much hemoglobin would be saturated at an  $O_2$  pressure of 7.3 kPa?
  - **A** 32%
  - **B** 67%
  - C 89%
  - **D** 92%

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## Solubility Rules

- 1. All sodium, potassium, and ammonium salts are soluble.
- 2. All silver, lead, and mercury salts are insoluble.
- 3. All carbonates, sulfides, and hydroxides are insoluble.
- 4. All sulfates are soluble except calcium sulfate and barium sulfate.
- 50 Which of the following salts has the greatest solubility in water at 25°C?
  - F CaCO<sub>3</sub>
  - G FeS
  - $\mathbf{H}$  HgCl<sub>2</sub>
  - $\mathbf{J}$  KClO<sub>4</sub>

 $Plants \rightarrow Aphids \rightarrow Spiders \rightarrow \overline{Sparrows}$ 

- **51** In this food chain, the spiders are
  - A producers
  - B primary consumers
  - C competitors
  - **D** secondary consumers

- 52 Objects of the same mass but of different sizes and shapes were dropped from a given height. Their rates of free fall were measured and recorded. Which of the following is most likely the question this experiment was designed to answer?
  - **F** How does height affect the force of gravity?
  - **G** How does gravity affect objects of different densities?
  - **H** How do mass and weight affect falling objects?
  - **J** How do size and shape affect an object's rate of free fall?

### **Bird Traits**

Gene	Trait
G	Green feathers (dominant)
g	Yellow feathers (recessive)
L	Long beak (dominant)
I	Short beak (recessive)

GGLI (male) × GgII (female)

- **53** What trait will most likely be observed in all offspring of the above set of parents?
  - A Green feathers
  - B Yellow feathers
  - C Long beak
  - D Short beak

- 54 As temperature drops to the dew point, clouds form in the atmosphere, and dew forms on ground surfaces. A scientist proposes that adding more water molecules to the atmosphere will change the dew point. This proposal is
  - F an invalid observation
  - G a valid hypothesis
  - **H** an invalid problem
  - **J** a valid conclusion

- **55** Laboratory equipment is cleaned and properly stored after use primarily so that
  - A chemical products can be measured and recorded as data
  - B time is saved in setting up the next experiment
  - C toxic materials can be kept in the laboratory
  - **D** the possibility of contamination in the laboratory is minimized

