



YOU BE THE CHEMIST

CHALLENGE™

2018-2019 Core of Chemistry **Practice** **Questions**

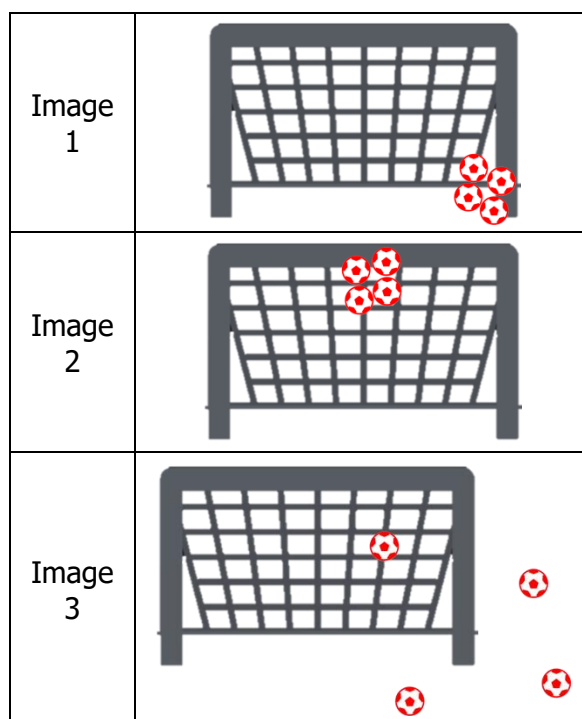
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—Students should be provided with CEF’s periodic table (competition version).—

(1) What type of substance is found in all matter in the universe?

- A. Compounds
- B. Elements
- C. Mixtures
- D. All the above

(2) Before a soccer game, Natasha practices aiming for the lower right corner of the goal. All her shots are precise. Which of the images below could represent where her shots went?



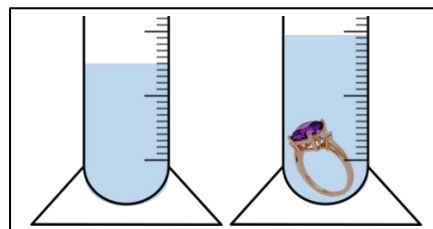
- A. Image 1 only
- B. Images 1 and 2 only
- C. Images 1 and 3 only
- D. Images 1, 2, and 3

(3) Which process is primarily a physical change?

- A. A seed growing
- B. Dough rising
- C. Dynamite exploding
- D. Glass shattering

- (4) Omar fills a graduated cylinder with 15 mL of water. He then drops a ring into the graduated cylinder and records that the water level is 19 mL. What did he measure?

- A. The ring's mass
- B. The ring's volume
- C. The water's density
- D. The water's weight



- (5) The deepest part of all the world's oceans is the Mariana Trench, which has a maximum depth of 11,000 m. How is this depth written in scientific notation?

- A. 1.1×10^3 m
- B. 1.1×10^4 m
- C. 11×10^3 m
- D. 11.000×10 m

- (6) What is the maximum number of controlled variables that there can be in a scientific experiment?

- A. 0
- B. 1
- C. 2
- D. There is no maximum

- (7) Alexis conducts an experiment studying how long it takes different watercolor paints to dry. What is a valid independent variable for her experiment?

- A. Brand of paint
- B. Color of paint
- C. Time needed to dry
- D. Both A and B



- (8) The most abundant element in the universe is hydrogen, which makes up about 75% of the universe's mass. What is the same for every particle of hydrogen in the universe?

- A. Number of electrons
- B. Number of neutrons
- C. Number of protons
- D. All the above

- (9) Nathan pours himself a glass of pineapple juice. What is a qualitative property of the juice?

- A. It freezes at -2 °C
- B. It has a density of 1.25 g/mL
- C. It has a volume of 240 mL
- D. It is a yellow solution

(10) What is true about the periodic table?

- A. All elements can be classified as either metalloids or nonmetals
- B. Elements are arranged in order of increasing atomic number
- C. Elements in the same row have similar chemical properties
- D. All the above

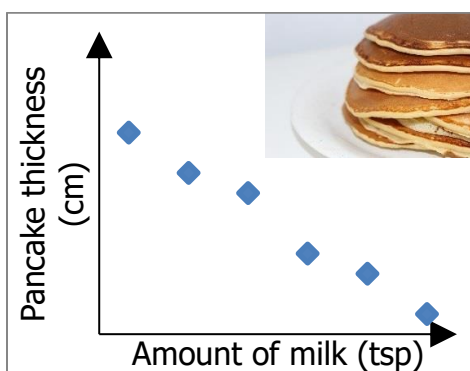
(11) A food chemist is studying a solid sample. Which property is she **least** likely to measure?

- A. Density
- B. Effusion rate
- C. Melting point
- D. Toxicity

(12) Which group of particles has the greatest mass?

- A. 1 neutron and 1 proton
- B. 1 proton and 10 electrons
- C. 2 neutrons and 10 electrons
- D. 3 neutrons

(13) Marcus conducts an experiment to improve his pancake recipe. His results are shown below. What could have been his initial hypothesis?



- A. Adding more milk makes pancakes thinner
- B. Adding more milk makes pancakes thicker
- C. The amount of milk does not affect a pancake's thickness
- D. All the above

(14) What primarily determines the volume of an atom?

- A. The size of the nucleus
- B. The size of the electron cloud
- C. The number of neutrons
- D. The speed of the electrons

- (15) An oceanographer has two liquid samples and records their masses in the table below. What **must** be true of samples 1 and 2?

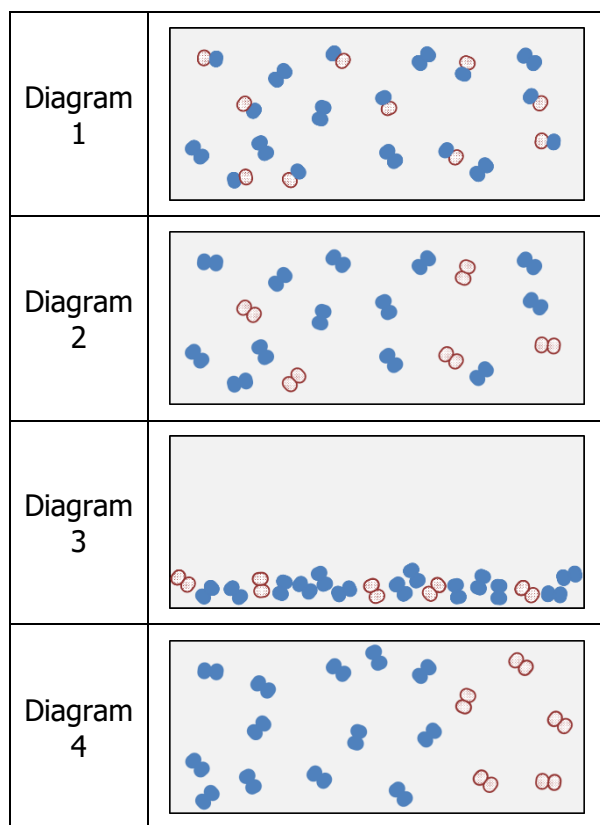
Sample	Mass
1	230 g
2	230 g

- A. They have the same chemical composition
 B. They have the same weight
 C. They take up the same amount of space
 D. All the above
- (16) Rose gold, which is often used to make jewelry, is an alloy of gold, copper, and silver. The copper gives the gold its reddish color. What is true of rose gold?
- A. It is mixed evenly throughout
 B. It cannot be broken down by normal chemical or physical means
 C. It does not conduct electricity
 D. It is a pure ternary compound
- (17) A drama teacher wants to know which shows get the most students to audition. He collects the data below and concludes that when a show has a larger cast, more students audition. What would improve his experiment?

Type of show	Cast size	Number of students who auditioned
Musical	50	62
Musical	30	60
Play	15	30
Play	10	27

- A. Offering more audition times for small shows
 B. Publicizing small shows more than large shows
 C. Recording how many people attended each show
 D. Testing either only plays or only musicals

(18) Scuba divers use tanks to breathe underwater. In these tanks, pure oxygen gas is mixed with pure nitrogen gas. Which diagram best represents a mixture of oxygen and nitrogen gas that has reached equilibrium?



- A. Diagram 1
- B. Diagram 2
- C. Diagram 3
- D. Diagram 4

(19) The earth's core contains liquid nickel and iron at temperatures greater than 4,000 °C. What **must** be true of pure liquid nickel in the earth's core compared to pure liquid nickel made in a factory?

- I. They have the same freezing point
- II. They have the same number of protons in each atom
- III. They react the same

- A. II only
- B. I and II only
- C. I and III only
- D. I, II, and III

(20) Lotions are often stored in glass bottles to protect them from UV light. A cosmetic chemist is testing what color glass best protects a lotion. What should be his control group?

- A. Lotion in a clear glass bottle
- B. Lotion in a plastic bottle
- C. Water in a clear glass bottle
- D. Water in a plastic bottle

(21) Liquid forms on cold cans of soda after they are taken out of the refrigerator through the process of condensation. What is this liquid formed from?

- A. Solid dust
- B. Suspended water droplets
- C. Tiny ice particles
- D. Water vapor



(22) Dmitri Mendeleev created the first modern periodic table, shown below, in the late 1800s. How did Mendeleev predict the existence of elements that hadn't been discovered yet?

0	I	II	III	IV	V	VI	VII	VIII			
	H 1.01										
	Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0				
	Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5				
	K 39.1	Ca 40.1		Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7	
	Cu 63.5	Zn 65.4			As 74.9	Se 79.0	Br 79.9				
	Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106	
	Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127				
	Ce 133	Ba 137	La 139		Ta 181	W 184		Os 194	Ir 192	Pt 195	
	Au 197	Hg 201	Tl 204	Pb 207	Bi 209						
				Th 232		U 238					

- A. He discovered the structure of atoms
- B. He organized the elements based on patterns of reactivity
- C. He related atomic number to the charge of an atom's nucleus
- D. He used X-rays to measure atomic numbers

(23) Silver chloride, AgCl, is a temperature-stable lightweight solid that darkens in sunlight. As a result, AgCl is used in glasses that darken in bright light. What chemical property of AgCl explains its use in glasses?

- A. It does not dissolve in water
- B. It reacts to form Ag and Cl atoms in UV light
- C. Its density is 5.56 g/cm³
- D. Its melting point is 455 °C

(24) A ball is rolling down a hill. What type of energy is the ball gaining?

- I. Kinetic energy
- II. Mechanical energy
- III. Potential energy

- A. I only
- B. III only
- C. I and II only
- D. II and III only

(25) Element X reacts similarly to oxygen and has the same number of electron shells as silicon. Based on rows two and three of the periodic table, shown below, what is element X?

	1	2	3 ... 12	13	14	15	16	17	18
2	3 Li Lithium 6.941	4 Be Beryllium 9.0122		5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984	10 Ne Neon 20.183
3	11 Na Sodium 22.9898	12 Mg Magnesium 24.305		13 Al Aluminium 26.9815	14 Si Silicon 28.086	15 P Phosphorus 30.9738	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948

- A. Boron
- B. Carbon
- C. Nitrogen
- D. Sulfur

Answer Key

See how you did! Check out the answers below.

- (1) B
- (2) B
- (3) D
- (4) B
- (5) B
- (6) D
- (7) D
- (8) C
- (9) D
- (10) B
- (11) B
- (12) D
- (13) D
- (14) B
- (15) B
- (16) A
- (17) D
- (18) B
- (19) D
- (20) A
- (21) D
- (22) B
- (23) B
- (24) A
- (25) D