

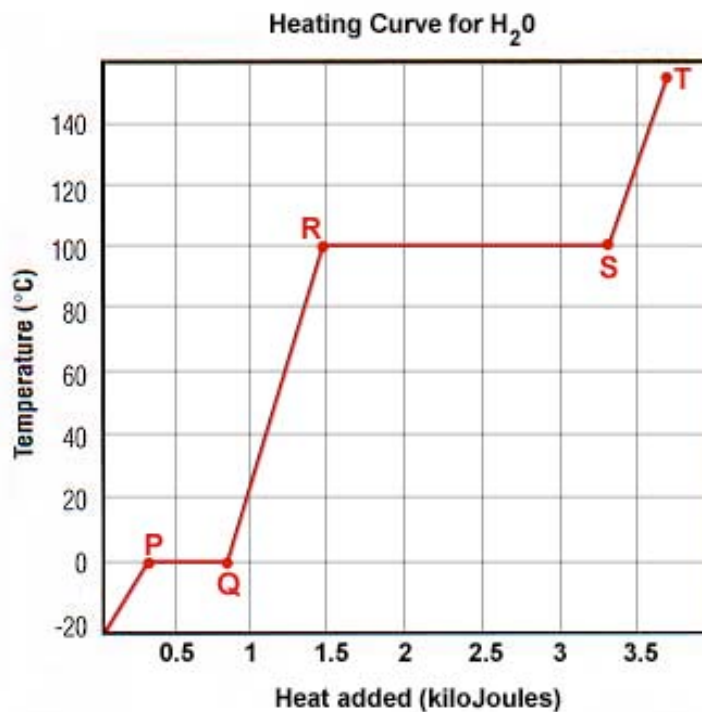
Physical and Chemical Sciences
The Nature of Matter

Additional FCAT Practice Questions

Directions: Select the best answer for each of the following questions

Phase Changes

1. The diagram below shows the heating curve for water (H_2O) in degrees Celsius ($^{\circ}C$).



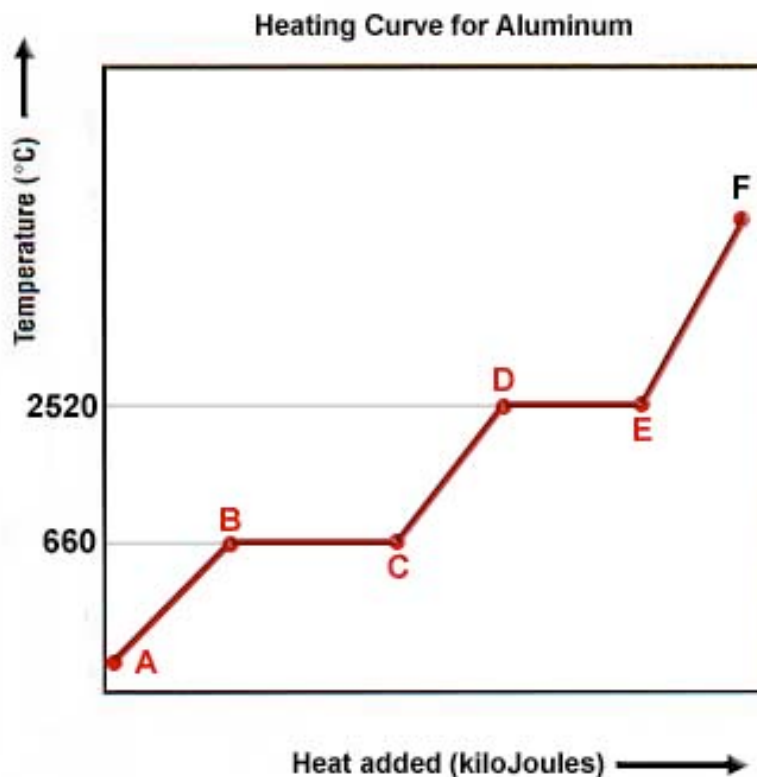
Which segment on the heating curve shows where water is boiling?

- A. PQ
- B. ST
- C. QR
- D. RS

2. One calorie will raise 1 gram of liquid water 1 degree Celsius. The boiling of 1 gram of water at 100 °C requires 540 calories.

If 1 gram of water at 90 °C is given 560 calories, will all the liquid water turn to steam, and what will the final temperature of the water be?

- A. some liquid water will remain, at 100 °C
B. all the water will be steam at 100 °C
C. all the water will be steam at 110 °C
D. some liquid water will remain, between 90°C & 100°C
3. The diagram below shows the heating curve for aluminum (Al) in degrees Celsius (°C).



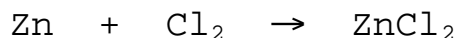
What can be concluded from this graph?

- A. Solid and liquid aluminum can coexist at 660 °C
B. The segment AB represents aluminum melting.
C. Aluminum boils at 660 °C.
D. The segments BC represents the warming of liquid aluminum.

4. Kelvin is boiling water for tea. The water in the pot boils, and this causes steam to be released. Which of the following happens as steam is produced from the water?
- A. The heat causes the water molecules to expand until they can no longer fit in the pot.
 - B. The water releases heat energy to the steam, leading to a cooling of the water and a heating of the steam.
 - C. Heat causes the water molecules to break apart, leading to the release of oxygen gas and hydrogen gas as steam.
 - D. Water absorbs heat energy, causing an increase in kinetic energy, leading to a phase change.
5. Ethan wishes to heat 10 grams of ice water, at 0 °C, to the boiling point at 100 °C. Each gram of water absorbs 540 calories for each Celsius degree that the water temperature is raised. How many calories are needed to raise this water to its boiling point?
- A. 540 000 calories
 - B. 5 400 calories
 - C. 54 000 calories
 - D. 54 calories

Reaction Rates

6. A sample of zinc (Zn) is placed in a closed reaction chamber filled with chlorine gas (Cl₂). The equation for the reaction is:



The reactants are combined under different conditions in order to measure the affect on the rate of reaction. The table below shows the results of the experiments:

Trial	Pressure of Cl₂	Form of Zn solid
1	low	powdered
2	high	powdered
3	high	chunk
4	low	chunk

Which reaction is the slowest?

- A. 4
 - B. 1
 - C. 2
 - D. 3
7. Consider the reaction in a closed system in which hydrogen gas (H₂) and nitrogen gas (N₂) react to produce ammonia gas (NH₃):



Which of the following affect the rate of the decomposition reaction?

- I. number of reactant molecules
 - II. energy of reactant molecules
 - III. pressure of product molecules
- A. I, II
 - B. I, III
 - C. II, III
 - D. I, II, III

8. The table below shows the relationship between the rate of a reaction and the temperature.

Trial	Temperature(°C)	Rate
1	30	1
2	40	2
3	50	4

What is the expected rate of reaction at 70 °C?

- A. 16
B. 6
C. 8
D. 11
9. Consider the reaction between hydrochloric acid (HCl) and solid calcium carbonate to produce calcium chloride (CaCl₂), water (H₂O), and carbon dioxide gas (CO₂):



Which of the following factors will affect the rate of this reaction?

- I. concentration
II. pressure
III. temperature
- A. I, III
B. I, II, III
C. II, III
D. I, II
10. Why does increasing the temperature of a reaction system increase the reaction rate?
- A. molecules gain energy and move faster
B. molecules lose energy and move slower
C. the activation energy is decreased
D. the activation energy is increased

Periodic Table

11. Consider some properties of the following elements:

Element	color	reactivity with water	common ion charge
Cs	silver	high	+1
Ca	silver	medium	+2
S	yellow	low	-2
I	violet	low	-1

What chemical property can be inferred for the element astatine (At)?

- A. has low reactivity with water and a violet color
 - B. has a high reactivity with water and a silver color
 - C. has a +2 charge and a silver color
 - D. has low reactivity with water and a yellow color
12. An element in Period 3 is found to be a non-metal that is chemically unreactive. What is the identity of this element?
- A. Ar
 - B. Ne
 - C. F
 - D. Cl

13. A certain non-metal element "X" in Period 2 forms the following compounds:



What is the identity of element X?

- A. phosphorus (P)
- B. sulfur (S)
- C. nitrogen (N)
- D. oxygen (O)

14. An argon (Ar) filled balloon slowly sinks in air, while a neon (Ne) filled balloon slowly rises in air. Xenon (Xe) can be made to react directly with fluorine (F), while helium (He) cannot.

What can be inferred about the properties of the element radon (Rn)?

- A. a radon filled balloon rises in air; radon will react directly with fluorine
 - B. a radon filled balloon rises in air; radon will not react with fluorine
 - C. a radon filled balloon sinks in air; radon will react directly with fluorine
 - D. a radon filled balloon sinks in air; radon will not react directly with fluorine
15. Gold forms these compounds:



From this it can be concluded that gold can form which ions?

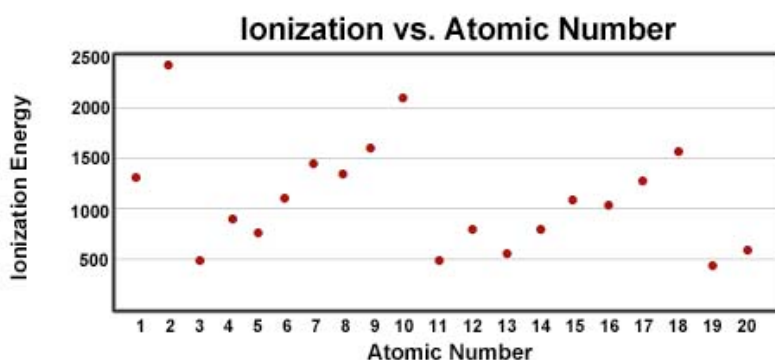
- A. Au⁺, Au²⁺, Au³⁺
- B. Au⁺, Au³⁺
- C. Au⁺, Au²⁺
- D. Au²⁺, Au³⁺

Electron Configuration

16. Use the following information for questions 16 and 17.

Ionization energy is a measure of the minimum amount of energy needed to remove an electron from an atom in the gas state. Low ionization energy means that it is easier to remove an electron than an atom with high ionization energy.

The following graph shows the electron configurations for the elements with atomic numbers 1 through 20.

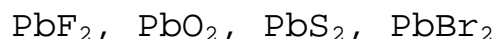


Notice that the ionization energy gradually increases from elements 3 through 10. What does this indicate about these elements?

- A. They are in the same chemical family.
 - B. They are in the same period.
 - C. They are in the same group.
 - D. They are all metals.
17. Considering the ionization energy graph, what do the elements with atomic numbers 3, 11, and 17 have in common?
- A. Their atoms easily gain one electron to become negatively charged ions.
 - B. Their atoms easily lose one proton to become negatively charged.
 - C. Their atoms easily lose one electron to become positively charged ions.
 - D. Their atoms easily gain one proton to become positively charged.

18. Which elements each gain 2 electrons in order to form ions with a charge of negative two?
- A. O, S
 - B. Li, Be
 - C. F, Cl
 - D. Mg, Ca

19. Lead (Pb) can form these ionic compounds:



What can be concluded about how lead forms ions?

- A. lead atoms gain 2 electrons or 4 electrons
 - B. lead atoms lose 2 electrons
 - C. lead atoms gain 2 electrons
 - D. lead atoms lose 2 electrons or 4 electrons
20. Copper (Cu), silver (Ag), and gold (Au) are known as coinage metals because throughout history they have been used in the making of coins for currency. They are practical for this purpose for several reasons. They have different colors. They are all relatively soft metals, and they all are, or were, somewhat rare.

What additional property makes these metals useful in the manufacture of coins?

- A. They can form ions with a positive charge.
- B. They lose electrons less readily than many other metals.
- C. They conduct electricity very well.
- D. They can form ions with a negative charge.

Waves

21. The electromagnetic spectrum includes X-rays, infrared rays, and ultraviolet rays. What property could be used to distinguish between these rays?
- A. amplitude of the wave
 - B. particle nature
 - C. frequency
 - D. speed of the wave in a vacuum
22. What is the frequency of a wave in which 100 crests pass a fixed point in 5 seconds?
- A. 100 Hz
 - B. 20 Hz
 - C. 0.050 Hz
 - D. 500 Hz
23. What is the wavelength of a wave that passes a fixed point from crest to crest in 10 s, if the wave is moving at 5 m/s?
- A. 50 m
 - B. 20 m
 - C. 2 m
 - D. 0.5 m

24. The following table contains data relating the form of radiation with its frequency:

Form	Frequency (Hz)
Radio	10^8
Ultra violet	10^{16}
X-rays	10^{19}
Gamma rays	10^{20}

Which form of radiation has the longest wavelength?

- A. Gamma rays
 - B. Ultra violet
 - C. X-rays
 - D. Radio
25. Consider the following

- I. wavelength
- II. amplitude
- III. frequency
- IV. crest height

Which can be used to distinguish red light from blue light?

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

Answers

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