Chapter 3 - Energy and Matter – Practice Problems

1) Helium is a(n)
   A) compound.
   B) heterogeneous mixture.
   C) element.
   D) homogeneous mixture.
   E) electron.

2) Air is a(n)
   A) compound.
   B) heterogeneous mixture.
   C) element.
   D) homogeneous mixture.
   E) None of the above.

3) Dimes, nickels, quarters in a piggy bank are a(n)
   A) compound.
   B) heterogeneous mixture.
   C) element.
   D) homogeneous mixture.
   E) None of the above.

4) Gold in a wedding ring is a(n)
   A) compound.
   B) heterogeneous mixture.
   C) element.
   D) homogeneous mixture.
   E) None of the above.

5) The primary substances of which all other things are composed are
   A) molecules.
   B) compounds.
   C) elements.
   D) electrons.
   E) protons.

6) Which of the following is a property of a solid?
   A) It takes the shape of the container.
   B) It fills the volume of the container.
   C) The particles move at a rapid rate.
   D) The interactions between its particles are very weak.
   E) The particles have fixed positions and are very close together.
7) Which of the following is a physical property of both liquids and gases?
A) has its own shape
B) has a definite volume
C) has strong interactions between its particles
D) has randomly arranged particles
E) has large spaces between molecules

8) Which one of the following properties describes a liquid?
A) has its own shape
B) particles are close together and move randomly
C) particles move very rapidly
D) fills the entire volume of the container
E) There is essentially no interaction between the particles.

9) Which of the following is an example of a physical change?
A) grinding coffee beans
B) baking a cake
C) converting water to hydrogen and oxygen
D) digesting a cheeseburger
E) burning coal

10) Which of the following would NOT be a physical change?
A) freezing water to make ice cubes
B) tearing a piece of aluminum foil
C) boiling water for soup
D) burning gasoline in a lawnmower
E) melting gold to make jewelry

11) Which of the following is a chemical change?
A) cutting a rope
B) bending a steel rod
C) making a snowman
D) burning sugar
E) melting gold

12) Which of the following is a physical change?
A) baking a cake
B) dry ice subliming
C) fermenting grapes to produce wine
D) digesting a meal
E) a tomato ripening
13) A temperature of 41 °F is the same as
A) 5 °C.
B) 310 °C.
C) -9 °C.
D) 16 °C.
E) 42 °C.

14) If the temperature is 20 °C, what is the corresponding temperature on the Fahrenheit scale?
A) -22 °F
B) 68 °F
C) 43 °F
D) 239 °F
E) 94 °F

15) If the temperature is -55 °C, what is the corresponding temperature on the Kelvin scale?
A) 225 K
B) 218 K
C) 55 K
D) 273 K
E) 328 K

16) A patient has a temperature of 38.5 °C. What is the temperature in degrees Fahrenheit?
A) 70.5 °F
B) 311 °F
C) 126.9 °F
D) 101.3 °F
E) 11.7 °F

17) The temperature of liquid nitrogen is -196 °C. What is the corresponding reading on the Kelvin scale?
A) 77 K
B) -127 K
C) -91 K
D) 48 K
E) 146 K

18) On a hot day, the thermometer read 95 °F. What is the temperature in degrees Celsius?
A) 77 °C
B) 113 °C
C) 35 °C
D) 63 °C
E) 178 °C
19) Absolute zero is
A) the freezing point of water using the Celsius scale.
B) the boiling point of liquid nitrogen.
C) the temperature on the Kelvin scale corresponding to 32 °F.
D) the coldest temperature possible.
E) the freezing point of liquid nitrogen.

20) 650. J is the same amount of energy as
A) 155 cal.
B) 2720 cal.
C) 650 cal.
D) 1550 cal.
E) 2.72 cal.

21) The energy associated with the motion of particles in a substance is called
A) temperature.
B) electrical energy.
C) heat.
D) chemical energy.
E) potential energy.

22) Which of the following is an example of potential energy?
A) chewing food
B) water stored in a reservoir
C) burning wood
D) a fan blade turning
E) riding an exercise bike

23) The phrase "ability to do work" is a definition of
A) specific heat.
B) energy.
C) calorie.
D) heating.
E) cooling.

24) The energy of motion is referred to as
A) work.
B) freezing.
C) specific heat.
D) potential energy.
E) kinetic energy.
25) In which of the following would the particles move most rapidly?
A) ice at -20 °C
B) water at 20 °C
C) steam at 110 °C
D) boiling water
E) ice at 0 °C

26) 3.25 kcal is the same amount of energy as
A) 3.25 J.
B) 0.777 J.
C) 777 J.
D) 13600 J.
E) 13.6 J.

27) A potato contains 20 g of carbohydrate. If carbohydrate has a caloric value of 4 kcal/g, how many kcal are obtained from the carbohydrate in the potato?
A) 5 kcal
B) 20 kcal
C) 40 kcal
D) 60 kcal
E) 80 kcal

28) The dietary calorie (Cal) is equal to
A) 1000 kilocalories.
B) 1000 calories.
C) 100 calories.
D) 10 calories.
E) 1 calorie.

29) A cheeseburger from a fast food restaurant contains 19 g of fat, 20 g of carbohydrate, and 28 g of protein. How many kcal of energy does the cheeseburger contain? (The accepted caloric values for foods are 4.0 kcal/g for carbohydrate, 9.0 kcal/g for fat, and 4.0 kcal/g for protein.) Report the answer to 2 significant figures.
A) 70 kcal
B) 360 kcal
C) 17 kcal
D) 630 kcal
E) 280 kcal
30) A serving of fish contains 50.0 g of protein and 4.0 g of fat. If protein has a caloric value of 4.0 kcal/g and fat has 9.0 kcal/g, how many kcal are in the serving? Report the answer to 2 significant figures.
A) 240 kcal
B) 54.0 kcal
C) 470 kcal
D) 220 kcal
E) 490 kcal

31) A slice of pizza contains 29 g of carbohydrate, 13 g of protein and an unknown amount of fat. If the pizza contains 280 kcal, how many grams of fat are present? Report the answer to 2 significant figures.
A) 10. g
B) 12 g
C) 25 g
D) 55 g
E) 250 g

32) One cup of kidney beans contains 15 g of protein, 1.0 g of fat, and 42 g of carbohydrate. How many kilocalories, to two significant figures, does this sample contain?
A) 60 kcal
B) 88 kcal
C) 230 kcal
D) 240 kcal
E) 520 kcal

33) The specific heat of a substance is the amount of heat needed to
A) change 1 g of the substance from the solid to the liquid state.
B) raise the temperature of 1 g of the substance by 1 °C.
C) change 1 g of the substance from the liquid to the solid state.
D) convert 1 g of a liquid to gas.
E) convert 1 g of a solid to a gas.

34) How many calories are required to raise the temperature of a 35.0 g sample of iron from 25 °C to 35 °C? Iron has a specific heat of 0.108 cal/g °C.
A) 38 cal
B) 1.1 cal
C) 3.8 cal
D) 93 cal
E) 130 cal
35) How many calories are required to increase the temperature of 13 g of alcohol from 11 °C to 23 °C? The specific heat of alcohol is 0.588 cal/g °C.
A) 83 cal
B) 0.63 cal
C) 92 cal
D) 0.54 cal
E) 170 cal

36) How many calories are required to raise the temperature of a 150. g sample of gold from 25 °C to 175 °C? The specific heat of gold is 0.0308 cal/g °C.
A) 4.62 cal
B) 116 cal
C) 22500 cal
D) 693 cal
E) 130 cal

37) Raising the temperature of 10.0 g of water from 10.0 °C to 20.0 °C requires 100.0 cal of energy, while raising the temperature of 10.0 g of aluminum from 10.0 °C to 20.0 °C requires 22 cal. More calories are required to heat the water because
A) water is a liquid and aluminum is a solid at 10.0 °C.
B) ten grams of water occupies a larger volume than 10.0 g of aluminum.
C) water has a greater potential energy than aluminum.
D) water has a larger specific heat than aluminum.
E) 10.0 °C is closer to the melting point of water than to the melting point of aluminum.

38) The number of calories needed to raise the temperature of 32 g of water from 12 °C to 54 °C is
A) 384 cal.
B) 1.3 cal.
C) 1300 cal.
D) 1700 cal.
E) 0.76 cal.

39) The specific heat of copper is 0.0920 cal/g °C, and the specific heat of silver is 0.0562 cal/g °C. If 100 cal of heat is added to one g of each metal at 25 °C, what is the expected result?
A) The copper will reach a higher temperature.
B) The silver will reach a higher temperature.
C) The two samples will reach the same temperature.
D) The copper will reach a temperature lower than 25 °C.
E) The silver will soften.
40) The physical state(s) present when a substance is melting is (are)
A) solid.
B) liquid.
C) gas.
D) solid + liquid.
E) liquid + gas.

41) The formation of a gas resulting from the escape of high-energy particles from the surface of a liquid is known as
A) evaporation.
B) deposition.
C) condensation
D) melting.
E) sublimation.

42) When a solid is converted directly to a gas, the change of state is called
A) freezing.
B) melting.
C) evaporation
D) condensation.
E) sublimation.

43) Which of the following does NOT involve a change of state?
A) melting ice
B) freezing water
C) vaporization of alcohol
D) sublimation of dry ice
E) transferring water into a thermos

44) The **best** definition of a heating curve: a graph that describes...
A) what a substance looks like as it is heated.
B) what happens to the particles of a substance as it is heated.
C) what happens to the heat applied as the temperature is increased.
D) the changes in the temperature and physical state of a substance as it is heated.
E) the chemical changes that occur as the substance is heated.
45) Which of the following does NOT represent a step on the heating curve of water?

A) The temperature of steam cannot exceed 100 °C.
B) The temperature of ice remains at 0 °C as it melts.
C) The temperature of liquid water increases linearly as it is heated.
D) The temperature of liquid water remains at 100 °C as it boils.
E) Both liquid water and ice are present at 0 °C.

Use the heating curve to answer the following questions
46) What physical state(s) correspond to **region A** on the cooling curve above
A) liquid and gas
B) liquid and solid
C) solid and gas
D) gas
E) solid
F) liquid

47) What physical state(s) correspond to **region B** on the cooling curve above
A) liquid and gas
B) liquid and solid
C) solid and gas
D) gas
E) solid
F) liquid

48) What physical state(s) correspond to **region C** on the cooling curve above
A) liquid and gas
B) liquid and solid
C) solid and gas
D) gas
E) solid
F) liquid

49) What physical state(s) correspond to **region D** on the cooling curve above
A) liquid and gas
B) liquid and solid
C) solid and gas
D) gas
E) solid
F) liquid

50) What physical state(s) correspond to **region E** on the cooling curve above
A) liquid and gas
B) liquid and solid
C) solid and gas
D) gas
E) solid
F) liquid
51) When a volcano erupts, 175 g of steam at 100.0 °C is released. How many kilojoules are lost when the steam condenses, then freezes, at 0.0 °C?

For water:
Heat of Vaporization: 2260 J/g
Specific Heat: 4.18 J/g°C
Heat of Fusion: 334 J/g

A) 15000 kJ
B) 150 kJ
C) 171000 kJ
D) 171 kJ
E) 112 kJ

52) Calculate the total heat, in joules, needed to convert 15.0 g of liquid ethanol at 25.0 °C to gas at its boiling point of 78.0 °C. Ethanol has a specific heat of 2.46 J/g °C and a heat of vaporization of 841 J/g.

A) 14.6 J
B) 1670 J
C) 14600 J
D) 150 J
E) 112 J