At Kolfe General Secondary School Physics Worksheet For Grade 11 from unit 5

I. Choose the correct answeer from the given alternatives.

Heat Evaporation:

1. If the container is made of a material with a higher coefficient of volume expansion than the liquid it holds, what will happen to the liquid when heated?
   A) The liquid will contract B) The liquid will expand less than the container
   C) The liquid will expand more than the container D) The liquid will remain the same size
   Answer: B
1. Which factor does NOT affect the rate of evaporation?
   A) Temperature B) Air pressure C) Humidity D) Density of the liquid
   Answer: D
2. At what temperature does water typically begin to evaporate?
   A) 0°C B) 100°C C) Any temperature above 0°C D) 212°C
   Answer: C
3. Evaporation occurs when molecules at the surface of a liquid have enough energy to:
   A) Freeze B) Escape into the air C) Change into solid crystals D) Boil
   Answer: B
4. Which of the following is an example of evaporation?
   A) Ice melting B) A puddle drying up C) Water boiling D) Water freezing
   Answer: B
5. Which of the following increases the rate of evaporation?
   A) High temperature B) Low humidity C) Increased surface area D) All of the above
   Answer: D
6. The cooling effect of evaporation is due to:
   A) Heat loss from the evaporating liquid B) Heat gain from the surroundings
   C) The phase transition to a gas D) Absorption of latent heat
   Answer: A
7. In the process of evaporation, the liquid absorbs:
   A) Latent heat B) Sensible heat C) Solar energy D) Internal energy
   Answer: A
8. Which of the following substances has the highest rate of evaporation at room temperature?
   A) Mercury B) Water C) Alcohol D) Glycerin
   Answer: C
9. Evaporation is a type of cooling process. Which of the following is a real-life example?
   A) Sweating on a hot day B) Ice melting in a drink C) Boiling water D) Freezing food
   Answer: A

   Heat Expansion:

11. When a substance is heated, its molecules move:

A) Slower B) Faster C) Stay the same D) Stop moving
Answer: B

12.Which of the following materials generally expands the most when heated?
A) Steel B) Wood C) Water D) Air
Answer: D

13.What is the primary cause of thermal expansion in most materials?
A) Increase in pressure B) Increase in the energy of molecules
C) Decrease in molecular vibration D) Loss of electrons
Answer: B

14.Which of the following is true about the expansion of water?
A) Water contracts when heated B) Water expands normally when heated
C) Water expands when cooled below 4°C D) Water expands linearly with temperature increase
Answer: C

15.The coefficient of linear expansion describes the fractional change in the length of a material per unit:
A) Volume increase B) Temperature change C) Mass change D) Pressure change
Answer: B

16.Which of the following materials has a low coefficient of thermal expansion?
A) Glass B) Aluminum C) Rubber D) Concrete
Answer: A

17.Which of the following is an example of thermal expansion in daily life?
A) A balloon shrinking in the cold B) A metal lid becoming tight on a jar in hot water
C) A water bottle expanding when frozen D) A puddle drying up in the sun
Answer: B

18.When a metal rod is heated uniformly, it expands:
A) In all directions equally B) Only in length C) Only in volume D) It does not expand
Answer: A

19.If a bimetallic strip made of copper and steel is heated, it will:
A) Remain flat B) Bend toward the copper side C) Bend toward the steel side D) Break apart
Answer: C

20.Why is expansion of materials considered important in engineering?
A) It helps in designing structures that can withstand temperature changes
B) It increases the density of materials
C) It decreases the melting point of materials
D) It reduces the need for insulation
Answer: A

21.Which of the following materials would expand the least when heated?
A) Lead B) Aluminum C) Iron D) Concrete
Answer: A

22.What happens to the volume of a gas when it is heated at constant pressure?

A) It decreases B) It remains the same C) It increases D) It turns into liquid

Answer: C

23. What is the main difference between thermal expansion in solids, liquids, and gases?

A) Solids expand much less than liquids and gases

B) Liquids and gases expand more than solids

C) Gases expand in volume more than liquids and solids

D) There is no difference in thermal expansion in all states of matter

Answer: C

24. In which of the following situations does a material undergo the most significant thermal expansion?

A) When the material is a gas at high temperature

B) When the material is a solid at high temperature

C) When the material is a liquid at low temperature

D) When the material is at low pressure

Answer: A

25. What will happen to a steel rail when the temperature increases?

A) It contracts B) It expands C) It stays the same size D) It melts

Answer: B

26. What is an example of a material that contracts when heated?

A) Water B) Most metals C) Concrete D) Mercury

Answer: D

27. In a bimetallic strip, what causes the strip to bend when heated?

A) Different rates of expansion of the metals B) The strip is coated with heat-sensitive material

C) One metal is lighter than the other D) One metal is more thermally conductive

Answer: A

28. Which of the following is an application of thermal expansion?

A) Bimetallic thermostats B) Car engines cooling down

C) Metal freezing at low temperatures D) Water expanding when frozen

Answer: A

29. When a metal expands due to heat, what happens to its density?

A) It increases B) It decreases C) It remains the same D) It fluctuates

Answer: B

30. Why do power lines sag during hot weather?

A) The metal expands and becomes longer B) The wires contract, becoming taut

C) The metal becomes brittle and weak D) The electrical current is higher

Answer: A

Heat Evaporation:

31. How much heat is required to evaporate 500 g of water at 100°C? (Latent heat of vaporization of water = 2260 J/g)

A) 1,130,000 J B) 2,260,000 J C) 500,000 J D) 5,000,000 J

Answer: B

Solution:

Heat required = mass × latent heat of vaporization

= 500 g × 2260 J/g

= 2,260,000 J

32.If 100 g of alcohol evaporates at room temperature, how much heat is absorbed if the latent heat of vaporization of alcohol is 850 J/g?

A) 85,000 J B) 1,850 J C) 8,500 J D) 8,500,000 J

Answer: A

Solution:

Heat absorbed = mass × latent heat of vaporization

= 100 g × 850 J/g

= 85,000 J

33.A 200 g of water at 80°C is evaporated. If the latent heat of vaporization of water is 2260 J/g, how much energy is needed?

A) 452,000 J B) 4,520,000 J C) 226,000 J D) 20,000 J

Answer: A

Solution:

Heat required = mass × latent heat of vaporization

= 200 g × 2260 J/g

= 452,000 J

34.If 50 g of a liquid evaporates at 100°C and the latent heat of vaporization is 1800 J/g, how much heat is required for evaporation?

A) 90,000 J B) 180,000 J C) 9,000 J D) 800,000 J

Answer: A

Solution:

Heat required = mass × latent heat of vaporization

= 50 g × 1800 J/g

= 90,000 J

35.How much heat is required to convert 100 g of water at 25°C to steam at 100°C? (Specific heat capacity of water = 4.18 J/g°C, Latent heat of vaporization = 2260 J/g)

A) 296,000 J B) 371,800 J C) 418,000 J D) 4,180,000 J

Answer: B

Solution:

Heat to raise temperature from 25°C to 100°C = mass × specific heat × temperature change

= 100 g × 4.18 J/g°C × (100°C - 25°C)

= 100 × 4.18 × 75

= 31,350 J

Heat to vaporize 100 g of water = 100 g × 2260 J/g

= 226,000 J

Total heat required = 31,350 J + 226,000 J = 371,800 J

Heat Expansion:

36. A metal rod of length 5 m expands by 0.02 m when heated. If the coefficient of linear expansion of the material is 1.2×10^{-5} /°C, what is the change in temperature?

A) 100°C B) 150°C C) 200°C D) 250°C

Answer: A

Solution:

$\Delta L = L_0 \times \alpha \times \Delta T$

Where:

ΔL = change in length = 0.02 m

L_0 = original length = 5 m

α = coefficient of linear expansion = 1.2×10^{-5} /°C

ΔT = change in temperature (to be calculated)

Rearranging the formula:

$\Delta T = \Delta L / (L_0 \times \alpha)$

$= 0.02 \text{ m} / (5 \text{ m} \times 1.2 \times 10^{-5} /°C)$

$= 0.02 / (6 \times 10^{-5})$

$= 333.33°C$

Answer: A

37. What is the increase in volume of a 2 m^3 copper block if its temperature increases by 50°C? (Coefficient of volume expansion for copper = 5.1×10^{-5} /°C)

A) 0.0051 m^3 B) 0.051 m^3 C) 0.51 m^3 D) 0.00051 m^3

Answer: A

Solution:

$\Delta V = V_0 \times \beta \times \Delta T$

Where:

ΔV = change in volume

V_0 = original volume = 2 m^3

β = coefficient of volume expansion for copper = 5.1×10^{-5} /°C

ΔT = change in temperature = 50°C

$\Delta V = 2 \text{ m}^3 \times 5.1 \times 10^{-5} /°C \times 50°C$

$= 0.0051 \text{ m}^3$

38. A steel rail is 12 m long at 20°C. If the coefficient of linear expansion for steel is 1.1×10^{-5} /°C, what is the change in length when the temperature increases by 40°C?

A) 0.0528 m B) 0.0532 m C) 0.052 m D) 0.054 m

Answer: A

Solution:

$\Delta L = L_0 \times \alpha \times \Delta T$

$= 12 \text{ m} \times 1.1 \times 10^{-5} /°C \times 40°C$

$= 0.0528 \text{ m}$

39. A glass bottle has a volume of 0.5 L at 20°C. The coefficient of volume expansion of glass is 2.5×10^{-5} /°C. What is the increase in volume when the temperature increases by 60°C?

A) 0.00075 L B) 0.0075 L C) 0.00025 L D) 0.0025 L

Answer: A

Solution:

$\Delta V = V_0 \times \beta \times \Delta T$

$= 0.5\ L \times 2.5 \times 10^{-5}\ /°C \times 60°C$

$= 0.00075\ L$

40.If a 10 m long aluminum rod expands by 0.5 cm when the temperature increases by 30°C, what is the coefficient of linear expansion of aluminum?

A) $1.67 \times 10^{-5}\ /°C$ B) $1.50 \times 10^{-5}\ /°C$ C) $2.00 \times 10^{-5}\ /°C$ D) $3.00 \times 10^{-5}\ /°C$

Answer: A

Solution:

$\Delta L = L_0 \times \alpha \times \Delta T$

$\alpha = \Delta L / (L_0 \times \Delta T)$

$\alpha = 0.5\ cm / (10\ m \times 30°C)$

$= 0.5 \times 10^{-2}\ m / (10\ m \times 30°C)$

$= 1.67 \times 10^{-5}\ /°C$

41.A brass rod with a length of 2 meters expands by 0.8 cm when heated. If the coefficient of linear expansion of brass is $1.9 \times 10^{-5}\ /°C$, by how many degrees Celsius was the temperature increased?

A) 30°C B) 40°C C) 50°C D) 60°C

Answer: B

Solution:

$\Delta L = L_0 \times \alpha \times \Delta T$

Rearranging for ΔT:

$\Delta T = \Delta L / (L_0 \times \alpha)$

$= 0.008\ m / (2\ m \times 1.9 \times 10^{-5}\ /°C)$

$= 40°C$

<u>Real, Apparent, and Coefficient of Volume Expansion:</u>

42.What is the real coefficient of volume expansion of a substance?

A) The rate at which the substance expands due to temperature change

B) The rate at which the liquid in a container expands due to temperature change

C) The rate at which the volume of a substance changes when it is subjected to external pressure

D) The rate at which the volume of a substance changes due to both temperature and external conditions

Answer: A

43.If a liquid is placed in a container, and the container expands along with the liquid, the apparent coefficient of volume expansion is:

A) The sum of the real coefficients of the liquid and container

B) Equal to the real coefficient of the liquid

C) Equal to the real coefficient of the container D) Zero

Answer: A

44. The apparent coefficient of volume expansion of a liquid inside a container depends on:
A) The temperature change B) The properties of the liquid only
C) The expansion of the container and the liquid D) The material of the container
Answer: C

45. When a container expands due to heat, the volume of a liquid inside it changes. If the container's coefficient of volume expansion is greater than that of the liquid, the liquid will:
A) Expand more than the container B) Contract
C) Expand less than the container D) Stay the same
Answer: C

46. What happens to the apparent volume of a liquid when both the container and the liquid expand at the same rate?
A) The volume of the liquid increases significantly B) The volume of the liquid decreases
C) The apparent volume remains the same D) The volume of the liquid becomes zero
Answer: C

47. The real coefficient of volume expansion is the rate at which the volume of a substance changes with temperature. If the real coefficient of volume expansion of a liquid is 3×10^{-4} /°C, and its initial volume is 500 cm^3, what is the change in volume for a 10°C rise in temperature?
A) 1.5 cm^3 B) 15 cm^3 C) 150 cm^3 D) 0.5 cm^3
Answer: B
Solution:
Change in volume = $V_0 \times \beta \times \Delta T$
= 500 $cm^3 \times 3 \times 10^{-4}$ /°C × 10°C
= 15 cm^3

48. The apparent coefficient of volume expansion of a liquid in a container is the sum of the real coefficients of the liquid and the container. If the real coefficient of volume expansion of the liquid is 4×10^{-4} /°C and that of the container is 2×10^{-4} /°C, what is the apparent coefficient of volume expansion?
A) 2×10^{-4} /°C B) 4×10^{-4} /°C C) 6×10^{-4} /°C D) 1×10^{-4} /°C
Answer: C

49. In which situation will the apparent coefficient of volume expansion be equal to the real coefficient of the liquid?
A) When the container does not expand B) When the temperature change is negligible
C) When the container and liquid expand at the same rate D) When the liquid is in a rigid container Answer: A

50. A container with a coefficient of volume expansion of 1.2×10^{-4} /°C is filled with a liquid that has a coefficient of volume expansion of 4.5×10^{-4} /°C. If the temperature increases by 25°C, what will be the apparent change in the volume of the liquid inside the container?
A) 5.85×10^{-3} cm^3 B) 0.25 cm^3 C) 8.85×10^{-3} cm^3 D) 0.035 cm^3
Answer: C
Solution:
Apparent coefficient = Coefficient of liquid + Coefficient of container

$= 4.5 \times 10^{-4}$ /°C + 1.2×10^{-4} /°C

$= 5.7 \times 10^{-4}$ /°C

Change in volume = $V_0 \times \beta \times \Delta T$

(Assume the initial volume of the liquid is 1 cm^3 for simplicity)

= 1 $cm^3 \times 5.7 \times 10^{-4}$ /°C × 25°C

= 0.00885 cm^3 Phase Change:

51.Which of the following is NOT a phase change?

A) Melting B) Freezing C) Condensation D) Boiling water

Answer: D

52.During the phase change from solid to liquid, the temperature of a substance:

A) Increases B) Decreases C) Remains constant D) Fluctuates rapidly

Answer: C

53.The heat required to convert 1 gram of a solid into a liquid without a change in temperature is called:

A) Latent heat of fusion B) Latent heat of vaporization

C) Specific heat capacity D) Sensible heat

Answer: A

54.The latent heat of vaporization is the heat required to:

A) Change a substance from a liquid to a gas at its boiling point

B) Change a substance from a solid to a liquid at its melting point

C) Heat a substance without changing its phase

D) Change a substance from gas to liquid at its boiling point

Answer: A

55.What happens during the process of freezing?

A) Heat is absorbed B) Heat is released

C) The substance remains at the same temperature D) The substance becomes a gas

Answer: B

56.Which of the following phase transitions requires the most energy?

A) Melting B) Boiling C) Sublimation D) Freezing

Answer: C

57.At what temperature does water freeze?

A) 0°C B) 100°C C) -273°C D) 212°F

Answer: A

58.Which of the following is true about sublimation?

A) A substance transitions directly from liquid to gas

B) A substance transitions directly from solid to gas

C) The substance transitions from gas to liquid

D) The substance changes from liquid to solid

Answer: B

59.The process in which a gas changes directly into a solid without passing through the liquid phase is called:

A) Sublimation B) Deposition C) Evaporation D) Freezing

Answer: B

60.Which of the following occurs when a substance undergoes a phase change at its boiling point

A) The temperature of the substance decreases B) The substance absorbs latent heat

C) The substance freezes D) The temperature remains constant

Answer: B

Calorimetry:

61.The amount of heat required to raise the temperature of 1 gram of water by 1°C is called:

A) Specific heat capacity B) Latent heat of fusion

C) Latent heat of vaporization D) Heat of reaction

Answer: A

62.The formula for calculating heat transfer is:

A) $Q = m \times \Delta T \times c$ B) $Q = m \times L$ C) $Q = mc \times \Delta T$ D) $Q = mc \times T$

Answer: A

63.In a calorimeter, the heat gained by the water is equal to:

A) The heat lost by the water B) The heat gained by the calorimeter

C) The heat lost by the object being heated D) The heat lost by the calorimeter and the object

Answer: C

64.A metal sample with a mass of 100 g is heated to 90°C and placed in 200 g of water at 20°C. If the final temperature of the water and metal system is 30°C, what is the heat absorbed by the water? (Specific heat capacity of water = 4.18 J/g°C)

A) 4180 J B) 8360 J C) 1000 J D) 500 J

Answer: A

Solution:

$Q = m \times c \times \Delta T$

$= 200\ g \times 4.18\ J/g°C \times (30°C - 20°C)$

$= 200 \times 4.18 \times 10$

$= 4180\ J$

65.The specific heat capacity of a substance is defined as the amount of heat needed to:

A) Change the temperature of 1 kilogram of the substance by 1°C]

B) Change the phase of 1 kilogram of the substance

C) Heat the substance to its boiling point

D) Evaporate 1 kilogram of the substance

Answer: A

66.If 50 g of a substance absorbs 300 J of heat and its temperature increases by 5°C, what is its specific heat capacity?

A) 1.2 J/g°C B) 6 J/g°C C) 1.5 J/g°C D) 5 J/g°C

Answer: A

Solution:

$Q = m \times c \times \Delta T$

Rearranging for c:

$c = Q / (m \times \Delta T)$

$= 300\ J / (50\ g \times 5°C)$

$= 300 / 250$

$= 1.2\ J/g°C$

67. The heat of fusion of ice is the heat required to:

A) Melt 1 gram of ice at its melting point B) Boil 1 gram of water at its boiling point

C) Sublimate 1 gram of ice D) Freeze 1 gram of water

Answer: A

68. The heat of vaporization is the amount of heat required to:

A) Change 1 gram of a substance from liquid to gas at its boiling point

B) Change 1 gram of a substance from solid to liquid at its melting point

C) Melt 1 gram of a substance at its freezing point

D) Evaporate 1 gram of a substance at its freezing point

Answer: A

69. A 0.5 kg block of aluminum is heated and placed in 2 kg of water. The water's temperature increases by 4°C after the block is added. If the specific heat capacity of aluminum is 0.900 J/g°C and the specific heat of water is 4.18 J/g°C, how much heat was transferred to the water?

A) 3000 J B) 16736 J C) 8368 J D) 4180 J

Answer: C

Solution:

Heat transferred to water = $m \times c \times \Delta T$

$= 2{,}000\ g \times 4.18\ J/g°C \times 4°C$

$= 33{,}440\ J$

70. In a calorimeter, when steam is condensed into water, the heat released by the steam is absorbed by the surrounding water. If 50 g of steam is condensed at 100°C, and the latent heat of vaporization is 2260 J/g, how much heat is released?

A) 113,000 J B) 226,000 J C) 50,000 J D) 450,000 J

Answer: A

Solution:

Heat released = mass × latent heat of vaporization

$= 50\ g \times 2260\ J/g$

$= 113{,}000\ J$

Good Luck!

P.B: T^2