

Thermodynamics Test Review A & C

⚠ This is a preview of the draft version of the quiz

Started: Feb 5 at 2:03pm

Quiz Instructions

Question 1

1 pts

A container holds a mixture of two **gases**, **Z2** and H2 in thermal equilibrium. Let K_c and K_h denote the average kinetic energy of a Z2 molecule and an H2 molecule, respectively. Given that a molecule of Z2 has 20 times the mass of a molecule of H2, the ratio K_c/K_h is equal to:

- None of these
- 1/20
- 20
- $\sqrt{20}$
- 1

Question 2

1 pts

If the temperature and volume of a sample of an ideal gas are both doubled, then a PV diagram will show what sort of shaped?

- A curve indicating a positive correlation
- A vertical line
- None of these
- A horizontal line
- A curve indicating a negative correlation

Question 3**1 pts**

An ideal gas is compressed isothermally from 50 m^3 to 10 m^3 . During this process, 15 J of work is done to compress the gas. What is the change of internal energy for this gas in Joules?

Question 4**1 pts**

An ideal gas is confined in a container with a fixed volume. The amount of gas, n , is slowly increased in the container. This experiment is done in such a way that the temperature of the gas remains constant. Pressure data is collected.

Which describes a graph with pressure on the vertical axis and amount of gas on the horizontal axis?

- The graph will be linear and a fit line will go through the origin (0, 0) will not be a data
- The graph will be (0, 0) will not be a data point.
- The graph will be (0, 0) will be a data point.
- The graph will be linear and a fit line will go through the (0, 0) will be a data point.

Question 5**1 pts**

An ideal gas is confined in a container with a fixed volume. The amount of gas, n , is slowly increased in the container. This experiment is done in such a way that the temperature of the gas remains constant. Pressure data is collected.

How could the experiment be done so that as the amount of gas is increased, the temperature remains constant?

- Allow heat to be added or removed from the gas so that T will remain

- Allow the pressure to change while n is changed so that T will remain

- Allow internal energy to be added or removed from the gas so that T will remain

- Allow work to be added or removed from the gas so that T will remain

Question 6**1 pts**

Through a series of thermodynamic processes, the internal energy of a sample of confined gas is increased by 900 J. If the net amount of work done on the sample by its surroundings is 450 J, how much heat in Joules was transferred between the gas and its environment?

Question 7**1 pts**

In one of the steps of the Carnot cycle, the gas undergoes an isothermal expansion. Which of the following statements are False concerning this step? Choose all that apply.

- The temperature decreases because the gas expands.

- The internal energy of the gas decreases due to the expansion.

- No heat is exchanged between the gas and its surroundings, because the process is isothermal.

- The internal energy of the gas remains constant.

Question 8**1 pts**

A cup of hot coffee is sealed inside a perfectly thermally insulating container. A long time is allowed to pass. Which of the following correctly explains the final thermal configuration within the box?

- The coffee has not changed temperature because the box is perfectly
- The coffee has gotten cooler but the air in the box has not changed its temperature. The energy from the coffee has caused an increase in entropy within the box.
- The coffee has gotten warmer and the air in the box has gotten cooler because of an exchange of thermal energy between the air and the coffee.
- The coffee has gotten cooler and the air in the box has gotten warmer because of an exchange of thermal energy between the air and the coffee.

Question 9**1 pts**

In an isothermal process _____.

- the temperature is zero
- the work is zero
- the heat added is zero
- the volume change is zero
- the internal energy change is zero

Question 10**1 pts**

In an adiabatic process, there is no _____.

- change in internal energy
- change in temperature
- change in pressure

- change in volume
- heat added or removed

Question 11**1 pts**

The first law of thermodynamics is essentially a statement of _____.

- internal energy
- thermal energy
- entropy
- conservation of energy
- heat transfer

Question 12**1 pts**

During a thermodynamic process, 400 joules of heat are removed from a gas while 200 joules of work are done on the gas. Determine the change in internal energy in Joules.

Question 13**1 pts**

During an adiabatic process, the internal energy of the gas increases by 1,200 J. How many Joules of energy are done on the gas?

Question 14**1 pts**

During an isometric process, 6250 joules of heat are removed from a trapped gas. Which statements are false?

- The volume of the gas is decreasing
- The volume of the gas is increasing
- The temperature of the gas is decreasing
- The temperature of the gas is increasing

Question 15**1 pts**

A heat engine operates between 75°C and 100°C. The theoretical efficiency is most nearly _____%.

Question 16**1 pts**

A heat engine absorbs 230 J of heat and exhausts 60 J to a cold reservoir. What is the efficiency of this engine as a percent?

Question 17**1 pts**

The entropy of isolated systems _____.

- remains constant
- is zero
- increases
- is one
- decreases

Question 18**1 pts**

Which of these are not a consequence of the second law of thermodynamics? Choose all that apply.

- No heat engine can ever be 100 percent efficient
- A heat pump requires energy from outside the system to operate
- The natural direction of heat flow is from hot to cold
- None of these
- The entropy of isolated systems always increases

Question 19**1 pts**

At constant temperature, an ideal gas is at a pressure of 40 cm of mercury and a volume of 6 L. If the pressure is increased to 55 cm of mercury, the new volume will be _____ L.

Question 20**1 pts**

At constant volume, an ideal gas is heated from 95°C to 130°C. The original pressure was 3.5 atm. After heating, the pressure will be ____ atm.

Question 21**1 pts**

At constant pressure, 12 m³ of an ideal gas at 35°C is cooled until its volume is halved. The new temperature of the gas will be ____ °C.

Question 22**1 pts**

Water is used in an open-tube barometer. If the density of water is 1,000 kg/m³, what will be the level of the column of water at sea level in meters?

Question 23**1 pts**

As the temperature of an ideal gas increases, the average kinetic energy of its molecules_____.

decreases

- increases, then decreases
- remains the same
- increases

Question 24**1 pts**

The product of pressure and volume is expressed in units of _____.

- watts
- kilograms per newton
- pascals P
- joules

Question 25**1 pts**

Which of the following is equivalent to 1 Pa of gas pressure?

- 1 kg/s²
- 1 kg * m/s
- 1 kg/m * s²
- 1 kg * m²/s²

Question 26**1 pts**

What is the efficiency % of a heat engine that performs 500 J of useful work from a reservoir of 1500 J?

Question 27**1 pts**

The first law of thermodynamics is a restatement of which law?

- Conservation of momentum
- Conservation of energy
- Conservation of entropy
- Conservation of charge

Question 28**1 pts**

During an isothermal process involving an ideal gas, the pressure of the gas is doubled. Which of the following statements is true?

- The volume remains constant.
- The temperature also doubles.
- The temperature remains constant.
- The volume and temperature of the gas also doubles.

Question 29**1 pts**

In a sealed, rigid container of an ideal gas held at constant volume, one would expect

- pressure to increase as temperature increases
- pressure to decrease as temperature increases

- the internal energy of molecules to decrease as temperature increases
- the average kinetic energy of molecules to decrease as pressure increases

Question 30**1 pts**

According to the first law of thermodynamics (the law of conservation of energy for thermodynamic systems), an increase in the temperature of a system during an adiabatic process is due to

- heat added to the system to increase the temperature of molecules
- work done by an external force on the system, increasing the kinetic energy of molecules
- work done by the molecules of the system in expanding themselves
- heat transferred from one part of the system to another

Question 31**1 pts**

A rigid container of an ideal gas is heated so that the absolute temperature of the gas doubles while the volume remains constant. The molecules of the gas

- have twice the average speed as before
- increase in pressure, so they do more work on the walls of the container
- have twice as much internal energy
- must give off energy, since they cannot expand

Question 32**1 pts**

An ideal gas at pressure P , volume V , and temperature T undergoes an isothermal process that changes the pressure to $3P$. What is the new volume of the gas?

- 1/3 V
- V
- 9 V
- 3 V

Question 33**1 pts**

A system of ideal gas molecules contains 3 moles of gas. 90 joules of work is done in compressing the gas as the gas gives off 15 J of energy. Then the gas is allowed to expand, doing 30 J of work on its surroundings. What is the net change in internal energy of the gas as a result of these processes in Joules?

Question 34**1 pts**

Which of the following statements is NOT always true regarding change in internal energy (U) of a system of an ideal gas?

Choose all that apply.

- Internal energy will increase if heat is added to the system and work is done on the system.
- Internal energy will decrease if work is done by the system during an isovolumetric process.
- Internal energy will increase if work is done on the system during an isobaric process.
- Internal energy will increase if heat is added during an isothermal process.

Question 35**1 pts**

Chamber X, a very large reservoir of gas at a temperature of 400 K, comes into thermal contact with chamber Y, a very large reservoir of gas at 300 K. During a certain time interval, 500 J of heat transfers from chamber X to chamber Y. Which of the following statements is true regarding entropy in this situation?

- the entropy change of chamber X is greater than the entropy change of chamber Y
- the entropy change of chamber Y is greater than the entropy change of chamber X
- once the chambers come to equilibrium, there has been no net change in entropy
- the entropy changes of chambers X and Y are equal

Question 36**1 pts**

Two isolated chambers of an ideal gas are in thermal contact with each other, Chamber X at a higher temperature T and chamber Y at a lower temperature T . If heat is transferred directly from Chamber X to Chamber Y,

- the amount of heat transferred out of Chamber X is greater than the heat transferred into Chamber Y
- the magnitude of change in entropy of each chamber is the same
- the magnitude of change in entropy of Chamber X is less than the magnitude of change in entropy of Chamber Y
- the magnitude of change in entropy of Chamber X is greater than the magnitude of change in entropy of Chamber Y

Question 37**1 pts**

The thermal conductivity of water is $0.609 \text{ W/m}\cdot\text{C}^\circ$, of oil $0.145 \text{ W/m}\cdot\text{C}^\circ$ and of alcohol $0.202 \text{ W/m}\cdot\text{C}^\circ$. Students are designing a container to maintain a constant temperature of a beaker of boiling water inside the container. The students decide to set the beaker into a liquid bath. With which of the following actions would the students be most successful in keeping the water boiling?

- set the beaker into water at 90°C.
- set the beaker into water at 80°C.
- set the beaker into alcohol at 80°C.
- set the beaker into oil at 90°C.

Question 38**1 pts**

Which of the following methods of energy transfer is due to the motion of fluids of varying densities?

- insulation
- conduction
- radiation
- convection

Question 39**1 pts**

A hot liquid can be cooled more quickly by stirring it with a silver stick. Which of the following actions would be even more effective in cooling the liquid?

- Replace the stick with one twice as long and twice the diameter.
- Replace the stick with one half as long and half the diameter.
- Replace the stick with one twice as long and half the diameter.
- Replace the stick with one half as long and twice the diameter.

Question 40**1 pts**

The rate at which heat flows by conduction from a hot chamber to a cold chamber through a steel rod may be increased by

- substituting a thinner steel rod of the same length
- decreasing the temperature of the hot chamber and increasing the temperature of the cold chamber
- substituting a shorter steel rod of the same diameter
- substituting a rod with the same dimensions but made of a material with higher specific heat

Question 41

1 pts

One method of heat transfer is radiation, which is transfer of energy by electromagnetic waves. This radiation is sometimes called

- gamma radiation
- visible light
- ultraviolet radiation
- infrared radiation

Question 42

1 pts

Which of the following statements describes the mechanism at the molecular level that causes the handle of a metal spoon placed into a kettle of very hot soup to become too hot to touch?

- The molecules in the end of the spoon in the soup absorb radiation from the hot soup that is transmitted as thermal energy to the handle of the spoon.
- The molecules in the end of the spoon in the soup have more kinetic energy gain energy from the soup. They are moving faster and collide more often with molecules next to them, giving them kinetic energy, and so on, until the molecules in the handle have higher kinetic energy too.

- The molecules in the end of the spoon in the soup begin to move faster as they gain energy from the soup, so those molecules move to the handle of the spoon, exciting other molecules in the handle of the spoon - making the handle feel hotter to the touch.
- The molecules in the end of the spoon in the soup move farther apart as they gain energy from the soup, making that end of the spoon less dense. As molecules from the handle move to the other end of the spoon to balance out the density, the handle becomes less dense and thus feels hotter.

Question 43**1 pts**

A solid door is made of a material with a thermal conductivity of $0.18 \text{ W/m}\cdot\text{C}^\circ$ and has the dimensions $3 \text{ m} \times 12 \text{ m} \times 2 \text{ cm}$ thick. The inside temperature is 70°C , and the outside temperature is 40°C . Determine the rate of heat transfer through the door in J/s.

Question 44**1 pts**

Which of the following quantities are normally increase with an increase in temperature?

Choose all that apply.

- the speed of sound in air
- the density of a gas
- electrical resistance
- the pressure of a gas at constant volume

Question 45**1 pts**

At room temperature, a brass ball has the same diameter as the inside opening of a brass ring, so the ball just barely fits through the ring. What happens if the ball and ring are heated together to a much higher temperature?

- The ball gets larger while the inside diameter of the ring remains constant
- The ball gets larger while the inside diameter of the ring gets
- The ball's diameter remains constant while the inside diameter of the ring increases
- The ball gets larger while the inside diameter of the ring gets

Question 46**1 pts**

A metal ruler is made of a material that has a coefficient of linear expansion of $15 \times 10^{-6} \text{ C}^\circ$. If the ruler is heated from 70°C to 130°C , by what percentage does the length of one centimeter on the ruler increase?

Question 47**1 pts**

A square metal plate 30 cm on a side is made off material that has a coefficient of linear expansion of $20 \times 10^{-6} \text{ C}^\circ$. If the plate's temperature is increased from 70°C to 90°C , what is the new area of the plate in cm^2 ?

Question 48**1 pts**

A small metal cube with a temperature of 308 K is placed in contact with a much larger cube of the same metal with a temperature of 290 K. Assuming no loss of energy to the environment around the cubes, which of the following statements are NOT true regarding the transfer of energy that takes place?

- The smaller cube will actually transfer more energy to the larger cube than the larger cube

transfers to the smaller one.

- The smaller cube will contain more internal energy than the larger cube after the two cubes reach an equilibrium temperature.
- The smaller cube will undergo a greater change in temperature than larger cube.
- After a long time, the final temperature of both cubes will be 299 K.

Question 49**1 pts**

A 1 kg block of metal at 200 K is brought into contact with a 3 kg block of the same metal at 300K. Assuming no loss of energy to the environment around the blocks, which of the following statements are NOT true regarding the temperatures of the blocks after a long time has passed?

- The final temperatures of the blocks can only be the same if the two blocks are made of the same materials.
- The final temperature of each block will be 250 K, because the block will reach thermal equilibrium.
- The temperatures of the two blocks will be the same, so all molecules will have the same average speed.
- The temperatures of the two blocks will be the same,so all molecules will have the same average kinetic energy.

Question 50**1 pts**

Thermal expansion is a myth.

- True
- False

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