Practice Quiz 3

These are Q's from old quizzes. I do not guarantee that the Q's on this year's quiz will be the same, or even similar.

B

The interior of a house is maintained at 22 degree C while the outdoor temperature is −5 degree C. The house looses heat at a rate of 40kW. What is the entropy increase of the universe per second because of this irreversible heat flow?

A) 12 J/K B) 13.5 J/K C) 15 J/K D) 16.5 J/K E) 18 J/K

C

A reversible heat engine operates between T_c = 10 degree Celsius and T_h = 100 degree Celsius. What is its efficiency?

A) 0.9 B) 0.6 C) 0.3 D) 0.0

C

An ideal gas goes through a free expansion from a volume of 3 cubic meters to a volume of 9 cubic meters. What's the change in entropy?

A) nRln2
B) −nRln2
C) nR
D) depends on the temperature of the ideal gas
E) 2nR

D

An engine with a mechanical power output of 17kW extracts heat from a source at 420K and rejects it to a 2000kg block of ice at it's melting point. How long can the engine operate at its efficiency? (Lf=334kJ/kg)

A) for ever B) 1 day C) 12 hours D) 6 hours E) 3 hours

A

A Carnot engine operates between a high temperature reservoir at 463K and a river with water at 285K. If it absorbs 3200J of heat each cycle, how much work per cycle does it do?

A) 1230 J B) 1981 J C) 1219 J D) 1970 J

B

Two mols of an ideal gas undergo a reversible isothermal expansion from 0.0280 cubic meters to 0.0420 cubic meters at a temperature of 25 degree Celsius. What is the change of entrpy of the gas?

A) 0.6 J/K B) 6 J/K C) 60 J/K D) 600 J/K E) zero

C

Two kilogram of ice at zero degree Celsius is melted and converted to water at zero degree Celsius. Compute its change in entropy, assuming the melting is done reversibly. The heat of fusion of water is Lf=334 kJ/kg.

A) 0 kJ/K B) 1 kJ/K C) 2 kJ/K D) 4 kJ/K E) 8 kJ/K

Could you cool the kitchen by leaving the fridge door open? What about heating the kitchen by leaving the oven open?

B

A) Yes; yes. B) No; yes. C) No; no. D) Yes; no.

A 500g circular pan 20cm in diameter has straight sides 6cm high and is made from metal of negligible thickness. To what maximum depth can the pan be filled with water and still float on water? The densoty of water is 1g/cubic-cm.

B

A) any depth
B) 4.5cm
C) 5.2cm
D) 3.8cm
E) never floats

A garage lift has 45cm diameter piston supporting the load. Compressed air with a maximum pressure of 500kPa is applied to a small piston at the other end of the hydraulic system. What is the maximum mass the lift can support?

E

A) 100kg
B) 1000kg
C) 2000kg
D) 4000kg
E) more than any of the above

A plant hangs from a 1cm diameter suction cup affixed to a smooth horizontal surface. What is the maximum weight that can be suspended in San Diego, where atmospheric pressure is about 100 kPa?

A

A) 10N
B) 20N
C) 40N
D) 80N
E) limit depends only on the structural engineering of cup and building.

Answer key for the above: BCCDABCBBEA

Which of the following statements is FALSE.

A) The difference in entropy between two states of a system is independent of the path between states.
B) Entropy is a quantitative measure of disorder.
C) Entropy can be measured in units of J/K
D) The total entropy change in one cycle of a carnot engine is zero.
E) The entropy of an isolated systen is conserved, i.e. constant.

Calculate the entropy change of 1.0 mol of an ideal gas that undergoes an isothermal transformation from an initial state of pressure 1.5 atm and volume 500 cm^3 to a final state of pressure 0.90 atm.

A) 1 J/K B) 5 J/K C) 10 J/K D) 50 J/K E) 100 J/K

In class we spent a lot of time discussing various thermodynamic processes in P–V diagrams. Let us consider instead S (Entropy) and T(temperature) as axes for our 2 dimensional diagrams. Which of the following statements is wrong?

A) A carnot cycle is a rectangle in the S–T plane.
B) An Isobar is a straight line in the S–T plane.
C) An isotherm is a straight line in the S–T plane.
D) An isochore is not a straight line in the S–T plane.
E) An adiabat is a straight line in the S–T plane.

An engine produces 380 kJ of mechanical energy accompagnied by a total heat flow into the engine of 760kJ. What is the efficiency of the engine?

A) 10% B) 30% C) 50% D) 70% E) 90^

One kilogram of iron at 80 degree Celsius is dropped into 0.5L of water at 20 degree Celsius. Calculate the final equilibrium temperature of the system. Specific heat of water is 4.18 J/(g K). Specific heat for Iron is 0.4 J/(g K).

A) 30 degree Celsius
B) 40 degree Celsius
C) 50 degree Celsius
D) 60 degree Celsius
E) 70 degree Celsius

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A) –10 J/K B) 0 J/K C) +10 J/K D) +30 J/K E) +50 J/K

An ideal gas in a cylinder with a moveable piston is connected to a temperature bath. The gas is now slowly compressed. (a) How does the entropy of the gas change? (b) How does the entropy of the temperature bath change?

A) both stay the same
B) (a) decreases (b) increases
C) (a) increases (b) decreases
D) (a) decreases (b) stays the same
E) (a) stays the same (b) decreases

A certain engine follows a closed thermodynamic cycle in which the heat flow into the system is 1kJ. What is the work done by the engine per cycle if all transformations in the cycle are approximately reversible?

A) Not enough information given.
B) −1kJ
C) 1kJ
D) −2kJ
E) 2kJ

How much work does it take to compress 30 mol of an ideal gas at a fixed temperature of 15 degree Celsius to half its volume?

A) 100 J B) 1000 J C) 5 kJ D) 10 kJ E) 50 kJ

Assume an ideal mono−atomic gas. Pick a point in the P−V diagram. Consider the adiabat and the isotherm that go through this point. What is the ratio of slopes (adiabat/isotherm) in this point?

A) 0.25 B) 0.5 C) 1 D) 2 E) 4

An ice cube is floating in a glass of water. Will the water level rise, fall, or remain the same when the ice cube melts?

A) rise B) fall C) stay the same

Answer key for the above: EBBCACBCEDC

Why does it require effort to keep order in your dorm room?

A) Because disorder is energetically favored.
B) Because humans have a natural affinity towards disorder.
C) Because of the many ways of arranging one's dorm room only few are perceived as ordered.
D) Because there's a force of nature towards disorder.

"The entropy of the universe can only increase." Is this an absolute statement or simply an excellent approximation?

A) It is the truth and nothing but the truth.
B) It is absolutely true because of the large number of microscopic particles that make up macroscopic particles.
C) It is only an approximation. However, a very good one because of the vast number of microscopic particles that make up macroscopic particles.

One kilogram of ice at zero degree Celsius is melted and converted to water at zero degree Celsius. Compute its change in entropy, assuming the melting is done reversibly. The heat of fusion of water is Lf=334 kJ/kg.

A) 0 kJ/K B) 1 kJ/K C) 2 kJ/K D) 3 kJ/K E) 4 kJ/K

An engine with a mechanical power output of 8.5kW extracts heat from a source at 420K and rejects it to a 2000kg block of ice at it's melting point. How long can the engine operate at its efficiency? (Lf=334kJ/kg)

A) for ever B) 1 day C) 12 hours D) 6 hours E) 3 hours

A fully loaded Volvo station wagon has a mass of 1950kg. If each of it's 4 tires is inflated to a gauge pressure of 230kPa, what is the total tire area in cintact with the road?

A) 100 square cm B) 1000 square cm C) 1 square meter D) 10 square meter

Answer key for the above: CCBCB