AP Physics 2 Algebra Based Practice Test Unit – 2 - : Thermodynamics

Question 1

If the volume of a balloon is expanded by $2L$ against a constant external pressure of $1.5atm$, how much heat energy would have to be added in order for the balloon to maintain the same temperature?

A. -1.33 J
B. -3 J
C. +1.33 J
D. +3 J

Question 2

Which of the following best defines the zeroth law of thermodynamics in variable form?

A. H = U + PV
B. $\eta_{th} < 100$
C. X = Y, Y = Z, X = Z
D. $\Delta U = Q - W$

Question 3

Which of the following is a true statement concerning the entropy of a system?

A. The entropy of a system can decrease only in the case of a reversible adiabatic process.
B. The entropy of a system can decrease, but only if the system is isolated and the process is irreversible.
C. The entropy of a non-isolated system can decrease only if the entropy of its surroundings increases by a greater amount.
D. The entropy of a system, whether it is isolated or non-isolated, can only increase.

Question 4

What is the temperature in Kelvin for 1mol of gas at 5atm and a volume of 10L?

Use: $1atm = 101.3kPa = 101325\frac{N}{m^2}$

$R = 8.314\frac{L \cdot kPa}{mol \cdot K}$

A. 609 K
B. 151 K
C. 228 K
D. 713 K

Question 5

2 mol of an ideal gas expands at a constant temperature of 0°C. If 1 kJ of energy is inputted into the system and the net change of internal energy ΔU=0, by what factor does the volume of the gas change?

A. 1.5
B. 0.67

C. 0.8
D. 1.25

Question 6
What is the ratio of the rate of effusion of carbon dioxide (CO_2) to nitrogen (N_2)?
A. 1.25
B. 0.80
C. 1.57
D. 0.64

Question 7
You have 5g of an unknown metal. If, after adding 227.7 J of energy to it, its temperature raises by 115°, what is the metal's specific heat?
A. 0.776 $\frac{J}{g^0C}$
B. 4.236 $\frac{J}{g^0C}$
C. 0.396 $\frac{J}{g^0C}$
D. 1.736 $\frac{J}{g^0C}$

Question 8
A gas with a fixed number of molecules has 40J of work done on it, and 15J of heat are transferred from the gas to the surroundings. What happens to the internal energy of the gas?
A. It increases by 55 J
B. It increases by 25 J
C. It decreases by 55 J
D. It decreases by 25 J

Question 9
Calculate the entropy change when 2kg of ice melts. Use: $H_f = 333.5\frac{kJ}{kgH_2O}$
A. $2.4\frac{kJ}{K}$
B. $6.0\frac{kJ}{K}$
C. $3.6\frac{kJ}{K}$
D. $1.2\frac{kJ}{K}$

Question 10
Which of the following is not one of the laws of thermodynamics?

A. At a temperature of absolute zero, all motion within a system ceases
B. All spontaneous processes must lead to an increase of entropy in the universe
C. Energy and mass are interconvertible
D. Energy can only be converted from one form to another; it cannot be created

Question 11

In an isothermal process, you are told that heat is being added to the system. Which of the following is not true?

A. The gas is expanding.
B. The average kinetic energy of the particles is remaining constant.
C. Work is being done by the system.
D. The pressure of the gas is decreasing.

Question 12

Suppose that a copper bar 2m long is raised from a temperature of 25°C to 100°C. If the coefficient of thermal expansion for copper is 1.7x 10^{-5} , what is the final length of the bar?

A. 2.0006 m
B. 1.0975 m
C. 2.0013 m
D. 2.0025 m

Question 13

An ideal heat engine uses the atmosphere as a low temperature reservoir and boiling water as a hot temperature reservoir. Water boils at 100°C. How much more efficient is the heat engine on a cold day (0°C) than when it is hot outside (30°C)?

A. 2.5 times more efficient
B. 2 times more efficient
C. 1.4 times more efficient
D. 3.1 times more efficient

Question 14

What is the average molecular kinetic energy of a gas at a temperature of 27°C?
Use:

$$k = 1.38 * 10^{-23} \ \frac{\mathrm{J}}{\mathrm{K}}$$

A. 4.6 $x10^{-23} J$
B. 6.21x $10^{-21} J$
C. 9.8 $x10^{-20} J$
D. 7.2 $x10^{-22} J$

Question 15

Determine the energy needed to bring a rigid metal can of volume 1.5L from a pressure of 1atm to 10atm. Use:

$$1atm = 101,325 \frac{N}{m^2}$$

$$1L = 1000cm^3 = .0001m^3$$

A. 137 J
B. 101 J
C. 145 J
D. 98.6 J

Question 16
A real gas becomes more like an ideal gas at _____ temperatures and _____ pressures.

A. Higher…lower
B. Higher…higher
C. Lower…lower
D. Real gases can never be made to act more like ideal gases.

Question 17
We have 15L of CO_2 gas at 10°C. We increase the temperature to 30°C, while keeping the pressure constant. What is the new volume?

A. 45 L
B. 5 L
C. 6.6 L
D. 16.1 L

Question 18
A piston alters the gas held in a sealed chamber. If 1000J of heat is added to the system when the piston compresses 2m at a constant force of 500N, what is the change in internal energy of the system?

A. 2000 J
B. 1000 J
C. 500 J
D. 0 J

Question 19
In an enclosed space capsule, the temperature increases from 13°C to 27°C. Determine the ratio of the final to initial pressures: $\frac{P_{final}}{P_{initial}}$.

A. 1.33
B. 2.08
C. 0.896
D. 1.05

Answer Key

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