Student Response Sheet - Answer Sheet

School: _____ V JV1 JV2 JV3

Student Names: _____

For each answer, fill in the blank or circle the correct response. For numerical answers, values should be written with the correct number of significant figures and units. Only answers written on this answer sheet will be graded.

Tiebreakers - 3, 4, 6, 13, 15, 16, 18, 22

1. _____
2. _____
3. _____
4. _____
5. _____
6. A B C D
7. A B C
8. A B C D
9. _____
10. _____ ,
    _____ , _____
11. _____
12. _____
13. A B C D
14. A B C D
15. A B C D
16. A B C D
17. A B C D
18. A B C D E
19. _____
20. A B C D E
21. A B
22. A B C D
23. A B C
24. A B C D
25. A B C D
26. _____

Thermodynamics Written Test

*Note: Answer all questions on the provided **Answer Sheet.** Be sure all answers include the appropriate units. Any answers written on this test will NOT be scored.*

1. What device is used to measure pressure?

2. What device is used to measure heat energy added to a system?

3. What scientist is famous for experimentally finding the mechanical equivalent of heat?

4. What mode of transportation and breakthrough helped to shift attention to calorimetry through the use of heat and coal?

5. Who won the 1920 Nobel Peace Prize in Chemistry(awarded in 1921) for their work explaining the Third Law of Thermodynamics?

6. The joule measures energy as the amount of energy needed to exert

A. One newton of force over a one meter distance
B. One kilogram of force over a one meter distance
C. One newton of force over a one yard distance
D. One kilogram of mass over a one meter distance

7. You are given the three beakers of water, each with its own temperature reading. Which of these beakers holds water that is closest to boiling?

A. 198 F
B. 112 C
C. 380 K

8.(2pts) Ethan has recently received a hamster for his birthday and would like to know about the energy it could produce by running on a spinning wheel. He finds online that a typical hamster has an average output of 0.630 watts of energy. Assuming that Ethan's hamster has the same average output, how much energy in Joules could his hamster generate if it ran for 20.0 minutes?

A. 756
B. 1900
C. 31.7
D. 12.6

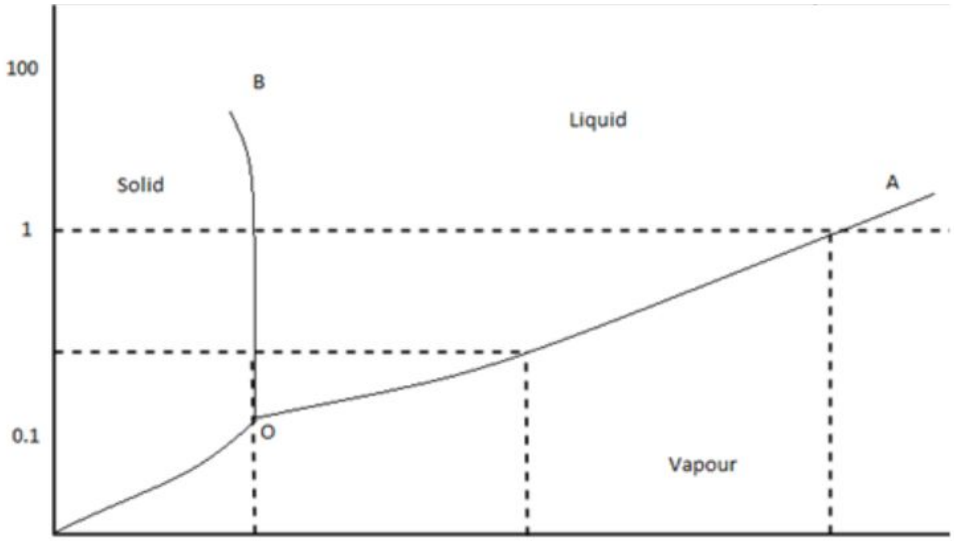
9. (3pts)The average human consumes 2.000×10^3 kilocalories a day. If a 60.0 W light bulb is kept on for 24.0 hours, how much more energy does the human use than the light bulb in a day, in Joules?

10. (3pts)You measure a cup of water to be 69.0 degrees Fahrenheit. What is the equivalent of this temperature on the Kelvin, Celsius, and Rankine scales?

11. (2pts)Nikhil would like to heat 250 g of water in the microwave to brew a glass tea before going to bed. Nikhil measures that the temperature of his tea has risen from 30.0°C to 95.0°. How many joules of energy have been absorbed by Nikhil's water while in the microwave?

12.(3pts) A sample of gas is confined to a 5.00 L container at 300.0 K and 100.0 kPa. What volume will the gas occupy when the pressure is reduced to 300.0 Torr and temperature is increased to 100.0°C?

13. In this figure, what does O denote?



A. Melting point
B. Boiling point
C. Triple point
D. Vaporization point

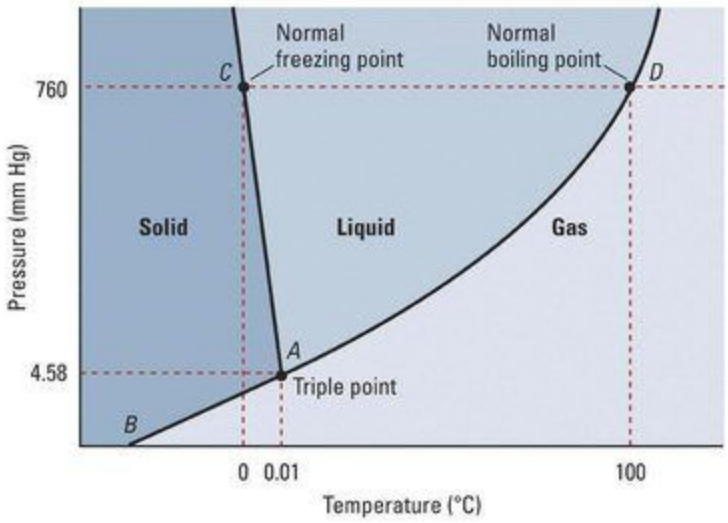
14. Let C represent the chemical constituents and P represent a phase. According to Gibb's phase rule, which expression is equal to the degrees of freedom?

A. $C + P + 1$
B. $C + P + 2$
C. $C - P + 2$
D. $C - P$

15. Which of the following cannot be obtained using a phase diagram?

A. Melting temperatures of various phases
B. Temperature range for solidification
C. Equilibrium solid solubility
D. Purity of materials

16. The pressure is increased on a sample of water at 0 °C from 0 mmHg to 800 mmHg. In order, what changes occur?



A. deposition, melting
B. condensation, freezing
C. sublimation, melting
D. deposition, freezing

17. The transfer of heat between two bodies in direct contact is called
A. Radiation
B. Convection
C. Conduction
D. None of the mentioned

18. Gases in the sun are heated and rise to the surface. A boy picks up a wrench which has been lying in the hot sun on a summer day. The order of heat transfers during this entire process is:
A. Conduction, convection, radiation
B. Convection, radiation, conduction
C. Radiation, convection, conduction
D. Convection, conduction, radiation
E. Radiation, conduction, convection

19.(3pts) The temperature of a sample of water increases from 20°C to 47°C as it absorbs 5650 joules of heat. What is the mass of the sample?

20. A student opens the top window and the bottom window in a hot room. Warmer air goes out of the top window, while cooler air comes in the bottom window. Which best explains why the room becomes cooler?

A. Reflection
B. Diffraction
C. Conduction
D. Radiation
E. Convection

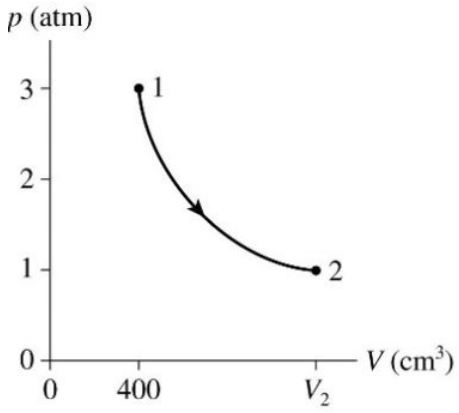
21. The specific heat of mercury is 0.140 cal/ g*C. Will mercury or water expand more when 40 J of heat is added to an equal mass of each substance at STP?

A. Mercury
B. Water

22. Consider a coal-fired power plant. In a given day, it yields 3.98×10^{13} J of net work. If in this same time period, the heat input at its high temperature 8.61×10^{13} J and the heat input at in its cooling tower is 5.28×10^{13} J, what is the ideal thermal efficiency of this power plant?.

A. 0.246
B. 0.462
C. 0.538
D. 0.754

23. The following graph is an example of an _____ process.



A. Isobaric
B. Isothermal
C. Isovolumic

24. What is the Law of Constant Heat Summation, which is used to calculate the change in the amount of heat within a system, better known as?

A. Dalton's Law
B. Hegrene's Law
C. First Law of Thermodynamics
D. Hess's Law

25. The changes in properties like temperature, pressure, and volume
    A. depend on the path taken
    B. are independent of path
    C. can be path independent or path dependent depending on the path
    D. none of the above

26.(3 pts) What is the maximum theoretical efficiency possible for an engine operating between 100.0°C and 400.0°C?

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1. Barometer
2. Calorimeter
3. Joule
4. Steam Engine
5. Walther Nernst
6. A
7. C
8. A **(2 pts)**
9. 3.184×10^6 J **(3pts)**
10. **(3pts)** 293.7 K, 20.55 C, 491.6 Rankine
11. 6,800 J **(2pts)**
12. 15.5L **(3 pts)**
13. C
14. C
15. D
16. A
17. C
18. B
19. 50. 1g **(3 pts)**
20. E
21. A
22. B
23. B
24. D
25. B
26. 0.4457 **(3pts)**