

Physics 105 Sample Exam 4

Ch.9

$$\text{stress} = F/A; \text{ strain} = \Delta L/L$$

$$Y = FL/A\Delta L$$

$$B = -V (\Delta P/\Delta V)$$

$$\rho = m/V$$

$$P = F/A$$

$$P = P_{\text{atm}} + \rho gh$$

$$P_{\text{atm}} = 1.01 \times 10^5 \text{ Pa}$$

$$= 14.7 \text{ lbs/in}^2$$

$$\rho_{\text{water}} = 1000 \text{ kg/m}^3$$

$$A_1 v_1 = A_2 v_2$$

$$R = \text{Vol}/t = Av$$

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho gy_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho gy_2$$

Ch. 10

$$\Delta L = \alpha L_0 \Delta T; \Delta V = 3\alpha V_0 \Delta T$$

$$\langle KE \rangle = \frac{1}{2} m \langle v^2 \rangle = \frac{3}{2} kT$$

$$v_{\text{rms}} = \sqrt{3kT/m} = \sqrt{3RT/M}$$

$$PV = NkT = nRT$$

$$T_F = 9/5 T_C + 32$$

$$T_K = T_C + 273.15$$

$$4.186 \text{ J} = 1 \text{ cal}$$

$$1 \text{ liter}\cdot\text{atm} = 101.3 \text{ J}$$

$$k = 1.38 \times 10^{-23} \text{ J/K}$$

$$R = 8.314 \text{ J/mol}\cdot\text{K}$$

$$N_A = 6.02 \times 10^{23}$$

Ch.11

$$Q = mc \Delta T$$

$$Q = mL$$

$$\frac{\Delta Q}{\Delta t} = kA \frac{(T_2 - T_1)}{L}$$

$$P = \sigma A_e (T^4 - T_0^4)$$

$$\sigma = 5.67 \times 10^{-8} \text{ W/m}^2 \cdot \text{K}^4$$

Ch. 12

$$W = -P \Delta V$$

$$\Delta U = Q + W$$

$$U_{\text{ideal gas}} = \frac{3}{2} nRT$$

$$\text{eff} = W/Q_H$$

$$\text{eff} = 1 - Q_C/Q_H$$

$$\text{eff}_{\text{max}} = 1 - T_C/T_H$$

A flexible helium balloon has a volume of 1.5 m^3 when it is launched at sea level and a temperature of 20°C . At a high altitude, where the air pressure has dropped to 0.25 atm , and the temperature has dropped to -80°C , the volume of the balloon will be [1S] _____ m^3 .

If a balloon doubles (2x) its radius due to expansion, its volume increases by a factor of [2S] _____

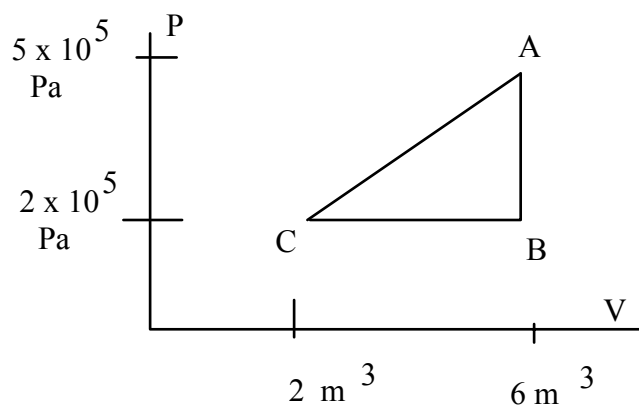
A 30 g piece of metal is at 20°C . It then absorbs 700 J of heat and ends up at 50°C . The specific heat of this metal is [3S] _____ $\text{J/kg}^\circ\text{C}$

The temperature of boiling water is the same for slowly boiling water and rapidly boiling water.

[4?] _____ 1) true 2) false

true.

The work done by a gas going from state A to state B in the diagram is [5S] _____ J.



The work done by the gas going from state B to state C

is [6S] _____ J and it is energy

[7S] _____ 1) into the gas 2) out of the gas.

The net work done by the gas going along a complete cycle ABCA is [8S] _____ J. The magnitude of the net heat exchanged with the gas for the complete cycle ABCA is [9?] _____ 1) smaller 2) the same 3) greater than the net work done.

The heat Q is the amount of energy that a system keeps after exchanging energy with its environment.

[10?] _____ 1) true 2) false.

In an adiabatic process the temperature of the gas can change even though no heat is added.

[11?] _____ 1) true 2) false

An *ideal* heat engine has an efficiency of 0.42. The temperature of the cold reservoir is room temperature, 20°C. The temperature of the hot reservoir in degrees C is [12S]_____ °C. The engine's useful power output is 8000 W. The power absorbed from the hot reservoir by the engine is [13S]_____ W. If the work done during one cycle is 3000 J, the time for one complete cycle of the engine is [14S]_____ sec.

Carnot told us that for the most efficient gas engine possible, we should keep the interior (pistons) of the engine as cool as possible [15?]_____ 1) true 2) false.

Consider a system composed of a mixture of gas vapor and air, such as you might find in your car piston. During part of the engine cycle, the hot gas *expands* and 800 J of work is done, and 600 J of heat flow *out* of the gas. The change in the internal energy of the gas during this time was [16S]_____ J, and was [17?]_____ 1) positive 2) negative 3) zero.

Your bedroom wall has dimensions 3 m x 2 m. You decide to make the wall out of rubber, which has a thermal conductivity of 0.2 J/(s m °C). You decide that you want only 500 W of heat to flow through the wall when the inside temperature is 25°C and the outside temperature is 10°C. The thickness of the wall should be [18S]_____ cm.

You mix 70 g of water at 100 °C with 20 g of water at 10 °C. The final temperature of the water is [19S]_____ °C. During the mixing process, the entropy of the universe _____ [20?] 1) increased 2) decreased 3) remained the same.

Fact: In a hydraulic jack you push on a piston which pushes on the fluid in a small cylinder. This fluid flows into a wider piston that holds the car. True or false: The reason that the car is on the wider piston is because the fluid pressure is greater in the large cylinder than in the small cylinder. [21?]_____ 1) true 2) false Neglect any height differences in the fluid.

A large wood raft is 3 m wide and 6 m long. A man of weight 590 N walks on to the raft from the shore. What is the weight of water the raft must displace to support him? [22S]_____ N. The raft will sink a distance of [23S]_____ m into the water when he walks onto the raft.

Suppose you are on the moon. If you try to use a straw to drink a soda from an open cup on the moon, it will be easier than on the earth. [24?]_____ 1) true 2) false (Assume the liquid doesn't evaporate)

A large aquarium at Sea World is pool is 4 m deep, 6 m long and 8 m wide. What is the difference in pressure between the top and the bottom of the aquarium? [25S]_____ N/m².

A fluid with density 3150 kg/m³ flows through a pipe of diameter 15 cm with speed 8 m/s. It opens into another pipe with different diameter, where the speed is 2 m/s. The diameter of the second pipe is [26S]_____ cm. The pressure difference between the fluid in the two pipes is [27S]_____ N/m². The pressure is greater in [28]_____. 1) the smaller pipe 2) the larger pipe 3) neither, P is the same in both.

Airplanes need lift to take off. In the cool morning, the density of air is different than in the hot part of the day. In the cool morning the lift on the wings is [29?]_____ 1) smaller 2) same 3) larger than in the hot afternoon, for the same airplane speed.

Suppose you are trying to put a metal rod into a hole in another piece of metal. The rod is a little too big to fit in the hole. To make the rod fit, you could cool down the piece with the hole. [30?]_____ 1) true 2) false

A closed, hard-walled cylinder contains a gas at a gauge pressure of -0.5 atm, at a temperature of 200 K. You heat it up until the gauge pressure is +0.5 atm. The final temperature of the gas is [31S]_____ K.

The atomic weight of carbon C is 12. The atomic mass of sulphur S is 32 g/mole. The molecular weight of CS₂ is [32S]_____ g/mole. The mass of one sulphur atom is [33S]_____ g.