Đề các năm Midterm physics 2

Physics 2 (Trường Đại học Quốc tế, Đại học Quốc gia Thành phố Hồ Chí Minh)

OCTOBER 2013

Question 1:

A plane is at an altitude of 10000 m where the outside air pressure is 0.25 atm. If the pressure inside the plane is 1.0 atm. What is the net outward force on a 1mx2m door in the wall of plane? (1 atm = $1.01*10^5$ Pa)

Question 2:

An aluminum ball of volume 4 cm^3 is dropped in water. Find the acceleration with which the ball sinks in the water. The density of water is 1g/cm^3 and the density of aluminum is 2.7 g/cm^3.

Question 3:

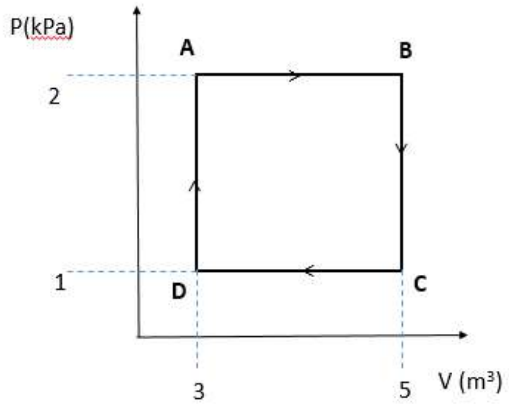
Two streams merge to form a river. One stream has a width of 8m, depth of 4 m and current speed is 2 m/s. The second stream is 7 m wide, 3m deep and flows at 4 m/s. If the river has a width of 10 m and a speed of 6m/s, how deep it is?

Question 4:

A cylindrical copper rod of length 1.5 m and cross-sectional area of 6.5 cm^2 is insulated to prevent heat loss through its surface. The ends are maintained at a temperature difference of 100°C by having one end in water-ice mixture and the other in boiliing water and steam. How much ice is melted per hour at the cold end? (Thermal conductivity of copper is k = 401 W/(m*K), heat of fusion of ice is $L_F = 333*10^3$ J/kg)

Question 5:

Two moles of an ideal gas is taken through a closed cycle ABCDA. Calculate the net work done by the gas and the net heat transfer during the cycle



APRIL 2013

Question 1: What force must be exerted on the cylinder of a hydraulic lift to support the weight of a 2000kg car (a large car) resting on the slave cylinder? The cylinder has a 2 cm diameter and the slave has a 24 cm diameter.

Question 2:

Water flow through a heating system. If water is pumped out at a speed of 0.5 m/s through a 4.0 cm diameter pipe in the basement under a pressure of 3 atm, what will be the flow speed and pressure in a 2 cm diameter pipe on the second floor 5m above? Assume pipes do not divide into branches (1atm = 10^5 Pa, 1000 kg/m^3)

Question 3:

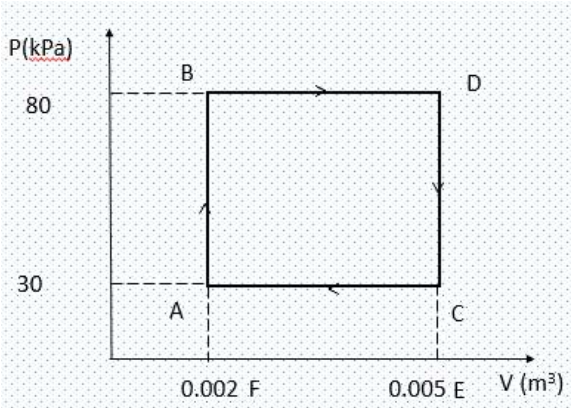
The coefficient of linear expansion of gold is $14.20*10^{-4}$/K. If the density of gold is 19.30 g/cm^3 at 20°C, what will be the density of gold at 90°C?

Question 4:

A copper rod has a length of 60 cm. One end is maintained at 100°C and the other end is at 40°C. In steady state, what is the temperature of the rod at the point which is 20 cm from the hot end?

Question 5:

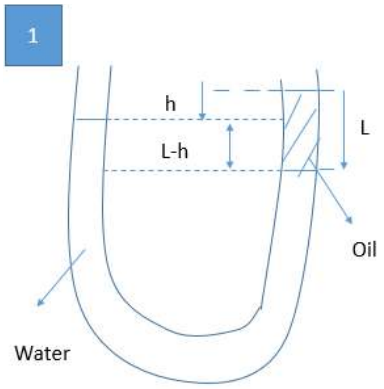
To the P-V diagram, 150 J of heat is added to the system in the process AB, and 600J of heat is added to the system in process BD. What is the total heat added in process ACD?



MARCH 2014

Question 1:

The density of oil is 0.85 g/cm^3 and the density of water is 1.0 g/cm^3. What is the height L of the column of oil shown in Fig.1 if h = 1.5 cm



Question 2:

A sprinkler is made of a 1.0 cm diameter garden hose with one end closed and 40 holes, each with a diameter of 0.05 cm, cut near closed end. If water flows at 2.0 m/s in the hose, what is the speed of water leaving a hole?

Question 3:

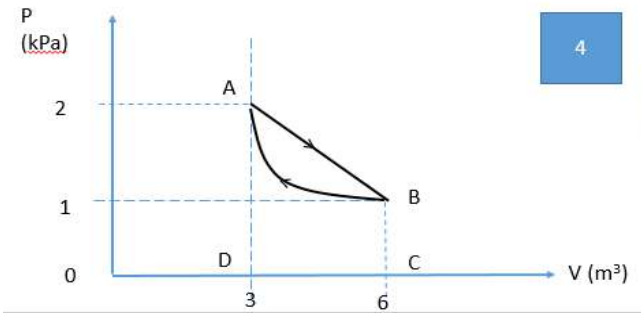
Two steel rods are each 1 m long at 29°C. Their ends are 1.00 mm apart. To what common temperature should they be heated up so that their ends touch at point A? (alpha steel = 11*10^{-4}/°C)

Question 4:

A cubical box (60 cm on edge and 3cm on thickness) contains ice at 0°C. When the outside temperature is 30°C, it is found that 250 gram ice melted per hour. What is thermal conductivity of the walls of the box? (Heat of fusion of ice L_F = 333*10^3 J/kg)

Question 5:

An ideal gas is taken through a closed cycle ABA. Calculate the net work done by the gas for the cycle ABA id the point A and B have the same internal energy and 4.16 kJ of heat released from the gas in the process from B to A?



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NOVEMBER 2014

Question 1:

A block of wood floats in water with one-thirds of its volume submerged. Determine the density of the wood if the density of water is 1000 kg/m^3

Question 2:

A cylinder is filled with water and a tightly fitting piston resting on top of the water. The pressure from the piston, not including the atmospheric pressure, on the top surface of water is 1000 Pa. A very small hole is opened at a depth of 70 cm below the initial water level of the cylinder. Find the initial speed of water coming out of the hole (ρ_{water} = 1000 kg/m^3)

Question 3:

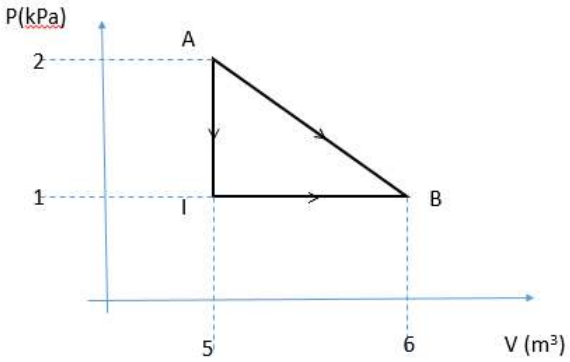
The volume of a metal sphere increases by 9.0*10^{-5} m^3 when its temperature is raised by 80°C. If the original volume is 2*10^{-2} m^3. What is the coefficient of linear expansion of the sphere?

Question 4:

A home has a door made of two layers of glass separated by an air layer. Each of the 3 layers has a thickness of 2.5 mm and an area of 3 m^2. The temperature outside the house is -10°C, while the temperature inside is 25°C. What is the rate of heat transfer by conduction through the door? Assume steady state, k_{glass}= 1.0 W/(m*K), k_{air} = 0.026 W/(m*K)

Question 5:

A gas expands along two different paths AB and AIB. The heat released from the path AB is 4.5 kJ. Find the energy transferred as heat along path AIB?



APRIL 2015

Question 1:

A heavy copper pot of mass 2.0 kg (including the copper lid) is at a temperature of 150°C. You pour 0.1 kg of water initially at 25°C into the pot then quickly close the lid of pot so that no steam can escape. Find the mass of water that changes to the gaseous phase. Assume that no heat is lost to the surroundings.

Question 2:

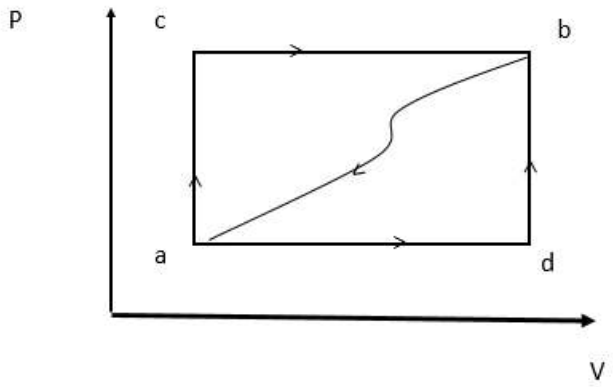
A steel ring with diameter of 2.5 cm inside diameter at 20°C is warmed so that it can slip over a brass shaft with 2.5020 cm outside diameter at 20°C. Coefficient of linear expansion for brass and steel are $2.0*10^{-5}$ and $1.2*10^{-5}$ K^{-1}, respectively.

a) **To what temperature should the ring be warmed?**
b) **If the ring and shaft together are cooled by some means such as liquid, air. To what temperature will the ring just slip off the shaft?**

Question 3:

When a gas system is taken from state a to state b along path acb, 90 J of heat flow into the system and 60 J of work is done by the system.

a) **How much heat flow into the system along path adb is the work done by the system is 15 J**
b) **When the system returns from b to a along the curved path, the absolute value of work done by the system is 35 J. Does system absorb or liberate heat? How much heat?**



Question 4:

Air streams horizontally past a small airplane's wings such that the speed is 70 m/s over the top surface. If the two wings have 16.2 m^2 of area and the net vertical force that the air exerts on the wings is 12600N, what is the speed of the air streams pass the bottom surface?

Suppose the wings are very thin. The density of the air is 1.2 kg/m^2.

NOVEMBER 2016

Question 1:

A plane is at an altitude of 10 km. The air pressure outside the plane is 0.22 atm. If the air pressure inside is 1 atm, determine the total force acting on the exit door of 0.85mX1.83m in the wall of the plane (assume 1 atm = $1.01*10^5$ Pa)

Question 2:

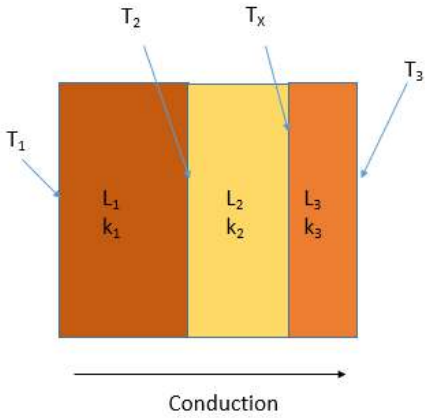
A water pipe carries water from ground to the first floor of a house. The pressure in the ground level and on the first floor are $2*10^5$ Pa and $1.1*10^5$ Pa, respectively. Water flows at 2 m/s in the ground level. If the first floor is above 4m above the ground, find the speed of water on the first floor (water density is 1000 kg/m^3)

Question 3:

The volume of a sphere increases by $20.4*10^{-6}$ m^3 when its temperature is raised by 100°C. Determine the coefficient of linear expansion of the sphere if its initial volume is $6.8*10^{-2}$ m^3.

Question 4:

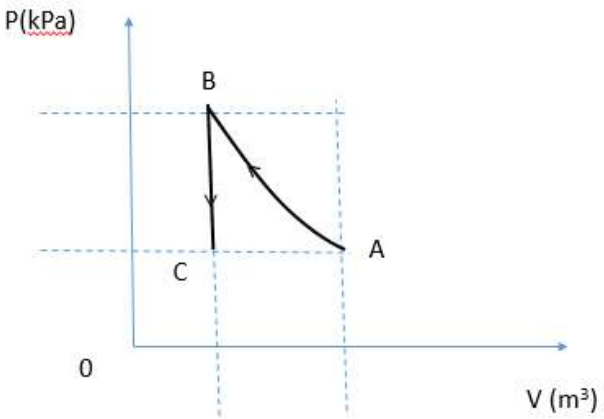
A wall is made of three layers with the same cross-sectional area. The thermal conductivity of the layers are k_1, $k_2 = 0.8\ k_1$ and $k_3 = 0.6\ k_1$. The thickness of the layers are L_1, $L_2 = 0.4\ L_1$, $L_3 = 0.3\ L_1$. Heat flows from the left to the right at a steady state. The temperatures at the interfaces are $T_1 = 37°C$, $T_2 = 32°C$. Determine T_3.



Question 5:

In the P-V diagram, the change in internal energy from B to C is -5 J. There is no change in internal energy when the gas moves from A to B

a) **Find the energy released as heat from the gas for the process from B to C**
b) **Find the work done by the gas for AB if the energy extracted from the gas as heat for ABC is 20 J.**



APRIL 2017 (1)

Question 1:

A pendulum consists of a brass sphere with a diameter of 35 cm suspended from a steel cable 10.5m long (both measurements are at 20°C). The swinging sphere clears the floor by a distance of only 2 mm when the temperature is at 20°C. At what temperature will the sphere begin to brush the floor?

(Given that $_{brass} = 2*10^{-5}$ /K,$_{steel} = 1.2*10^{-5}$ /K)

Question 2:

Suppose that 1g of water vaporize isobarically at atmospheric pressure $1.01*10^5$ Pa. Its volume in liquid state is 1 cm^3, and its volume is gas phase is 1671 cm^3. Find the work done in the expansion and the change in internal energy of the system (heat of vaporization of water is $2.26*10^6$ J/kg)

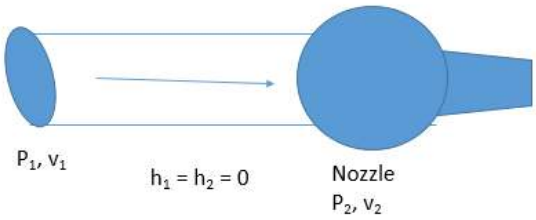
Question 3:

An insulated beaker with neligible mass contains 0.25 kg of water at 75. How many kg of ice at -20 must be dropped into the water to achieve the final temperature of 30.

(c_{water} = 4190 J/kg.K, c_{ice} = 2100 J/kg.K, $L_F = 334*10^3$ J/kg)

Question 4:

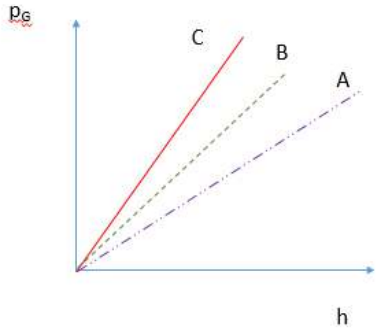
Water is flowing in the fire hose with a velocity of 1 m/s and a pressure of $2*10^5$ Pa. At the nozzle the pressure decreases to atmospheric pressure $1.01*10^5$ Pa. There is no change in height. What is the velocity out of nozzle



APRIL 2017 (2)

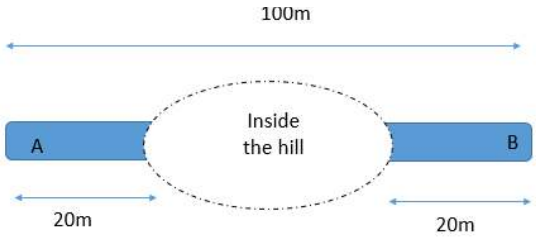
Question 1:

The gauge pressure P_g is plotted versus depth h is plotted for three liquids. For a rigid plastic box fully submerged in each liquid, ranks the plot according to the magnitude of the buoyant force acting on the box, greatest first. Explain your results.



Question 2:

The figure shows two sections of an old pipe system that run through a hill, with distances $d_A = d_B = 20$ m. D = 100m. On each side of the hill, the pipe radius is 2 cm. However, the radius of the pipe is no longer known. To determine it, hydraulic engineers first establish that water flows through the left and the right sections at 2 m/s. Then they release the ink in water at point A and find that it takes 70 seconds to reach point B. Determine the average radius of the pipe inside the hill?



Question 3:

The average global temperature on the Earth has increased by about 0.8°C due to global warming effect. Determine the percentage of volume of the ocean has been increase due to expansion ($\beta = 2.07*10^{-4}$ /°C)

Question 4:

In the P-V diagram, 150J of heat is added to the process AB and 600 J of heat is added in BD. Find the total heat added to process ACD.

Question 5:

A closed cubical box (60cm on edge and 5cm on thickness) contains ice at 0°C. When the outside temperature is 20°C, it is found that 250 grams of ice melted each hour. Find the thermal conductivity of the walls of the box. ($L_f = 333*10^3$ J/kg)

JULY 2019

Question 1: An iron anchor appears 200N lighter in water than in air. Known that the density of water is 10^3 kg/m^3.

a) **Volume of the anchor = ?**
b) **How much does the anchor weigh in air where its density is 7870 kg/m^3**

Question 2: A liquid of density 900kg/m^3 flows through a horizontal pipe that has cross-sectional area of 0.25 m^2 at region A and 0.5 m^2 at region B. The pressure difference between the two regions is $7.2*10^3$ Pa. What is the velocities via region A and B of the pipe?

Question 3: How much water remains unfrozen after 53.28 kJ is transferred as heat from 250g of liquid water initially at the freezing point? The latent heat of fusion of water is $3.33*10^5$ J/kg.

Question 4: A wall made of a material of thermal conductivity k = 0.12 W/m.K. The thickness of the wall is 15 cm and its area is 2.5 m^2. The temperature of one side of the wall is at 10°C while the other side is at -5°C. Find the energy transferred through this wall in 2 hours?

Question 5: Fig.2 displays a closed cycle for a gas. The change in internal energy along path CA is $\Delta E_{int,CA}$ = -160J. The energy transferred to

the gas as heat along path AB and path BC are Q_{AB} = 210J and Q_{BC}=40J. How much work is done by the gas along path ABC and path AB?