إعادى الترم الاول ٢٠١٩

(11)

Menofia University
Faculity of Electronic Engineering
Dept of Physics and Engineering Maths.
Time: 3hours - course code: PM003
Full mark: 90

Exam of Physics (1)
For Preparatory Year
First Term
Date: 2/1/2019
From 10am: 1pm

(Heat)

اجب عن أسئلة الحرارة في نصف منفصل من ورقة الإجابة وخواص المادة في النصف الأخر.
اقرأ السؤال جيدا واجب عن المطلوب فقط ولاتزيد.(أسئلة الحرارة ورقة واحدة وجهان)

Answer all the following:

[45 marks]

Question 1[15 marks]

a) Steam initially at a temperature of 130 °C is cooled to a temperature of 20 °C below the freezing point of water, the loss of heat energy being at a constant rate. Make a sketch, and briefly explain, the expected temperature/ time graph representing this change [3 marks]

b) A zinc sphere has a radius of 30.0 mm at a temperature of 20°C. If the temperature of the sphere is raised to 420°C, determine the increase in:
(a) the radius, (b) the surface area, (c) the volume of the sphere. Assume the coefficient of linear expansion for zinc to be $31 \times 10^{-6}\ K^{-1}$. [3 marks]

c) A copper calorimeter of mass 180 g contains 450 g of water and 50 g of ice, all at 0 °C. Dry steam is passed into the calorimeter until a certain temperature, θ, is reached. The mass of the calorimeter and its contents at the end of the experiment increased by 25 g. If no heat was lost to the surroundings find the final temperature, θ. Take the specific heat capacities of water and copper to be 4200 J kg^{-1} K^{-1} and 390 J kg^{-1} K^{-1}, respectively. Take the specific latent heat of fusion of ice to be 3.36×10^5 J kg^{-1} and the specific latent heat of vaporization of water to be 2.26×10^6 J kg^{-1}. [6 marks]

d) A spherical body of 2.0 cm diameter is maintained at 600 °C. Assuming that it radiates as if it were a black body (the emissivity of a black body is unity). At what rate in (watts) is energy radiated from the sphere? (Stefan- Boltzmann constant $\sigma = 5.67 \times 10^{-8}$ w/m^2. K^4) [3 marks]

7- How much heat in kcal is needed to melt a 10 kg block of aluminum that has an initial temperature of 30 °C? (The specific heat, latent heat of fusion, and melting point of aluminum are 0.215 cal/g.°C. 94.8 cal/g and 660 °C)

a)1355 b)2300 c)750 d)430 e) 215

8- A liquid has a volume V_1 at temperature θ_1. The temperature is increased to θ_2. if γ is the coefficient of volume expansion, the increase in volume is given by:

a)$(V_1 \gamma (\theta_2 - \theta_1)$ (b) $V_1\gamma\theta_2$ (c) $V_1 + V_1 \gamma\theta_2$ (d) $V_1 [1 + \gamma(\theta_2 - \theta_1]$

9-In an adiabatic free expansion

a) no heat is transferred between a system and its surroundings
b) the pressure remains constant
c) the temperature remains constant
d) the volume remains constant
e) the process is reversible

10- The temperature of pure melting ice is

a) 373 K (b) 273 K (c) 100 K (d) 0 K) e)32K

b) If 25 kg of ice at 0°C is combined with 4 kg of steam at 100°C, what will be the final equilibrium temperature (in °C) of the system? (Latent heat of fusion is 80 cal/g; Latent heat of condensation is 540 cal/g; specific heat of water is 1 cal/g-°C. [2 marks]

c) Explain experimentally a method how to determine the mechanical equivalent of heat? [2 marks]

d) Define the entropy, how to predict the sign and the size of the entropy change in the following reaction [1 mark]

$$K_{(solid)} + \frac{1}{2}Cl_{2(gas)} \rightarrow KCl_{(solid)}$$

Question No	Q1				Q2				Q3			
	a	b	c	d	a	b	c	d	a	b	c	d
A-Knowledge& Understanding	....	....	....	....	a5	a5	a5	....	a5	a5	....	a5
B- Intellectual skills	b7	....	....	....	b7	b7	b7	....	b7	b7	....	b7
C-Professional and practical skills	c12	c12	....	....	....	....	....	c12	....	....	c12	....
D-General and transferable skills	d9	d9	....	....	....	....	....	d9	....	....	d9	....

Best wishes
Dr. Ahmed Hassouna

Question 3[15 marks]

a) Chose the most appropriate answer [10 marks]

1-A copper cup of mass 0.300 kg contains 1.00 kg of water at 315 K. it is cooled so that the temperature decreases by 2.5 K each minute. What is the rate of removal of thermal energy in watts? The specific heat of water is 4186 J/kg. and the specific heat of copper is 387 J/kg.

a)122 b)185 c)179 d)162 e)173

2- Two beakers of water are on the lab table. One beaker has 30 g of water at 80 °C and . the other has 80 g at 30 °C. Which one would require more thermal energy to raise its temperature from 0 °C to its present temperature

a) The 30 g beaker b) The 80 g beaker

c)Both would require the same amount of thermal energy

d)Neither would require thermal energy to increase its temperature

e) We can't tell until we know the specific heat.

3- The 0.75 cm thick windows of a house have a total surface area of 9.0 m^2. The thermal conductivity of the single pane glass is 0.80 W/m.°C, how much thermal energy in J does the home lose in 2 hours by heat conduction through its windows when the inside temperature is 22 °C and the outside temperature is -4 °C?

a) 9.1×10^8 b) 1.1×10^9 c) 9.1×10^{10} d) 1.1×10^{11} e)1.8×10^8

4-The first law of thermodynamics is concerned with the conservation of

a) Momentum b) energy c) mass d) temperature e) thermal expansion

5- We are able to define a mechanical equivalent for heat because

a) some thermal energy can be converted into mechanical energy

b) mechanical energy can be converted thermal energy

c) work can be converted into thermal energy

d) some thermal can be converted into work

e) all of the above can occur

6- A difference of temperature of 25 C is equivalent to a difference of

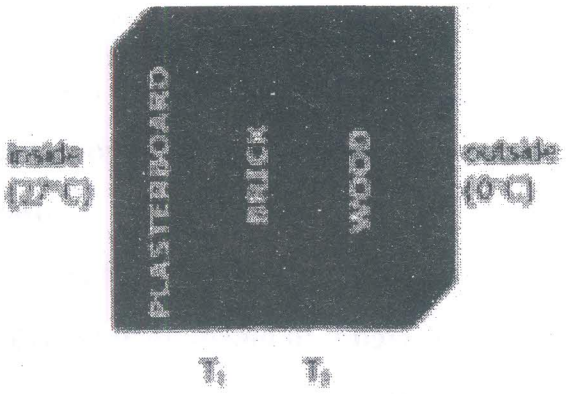
a) 45 °F b) 32 °F c) 25 °F d) 92 °F e)72 °F

[Question 2[15 marks]

a) A block of ice is kept pressed against one end of a circular copper bar of diameter 2 cm, length 20 cm, thermal conductivity 90 SI units and the other end is kept at 100 °C by means of a steam chamber. How long will it take to melt 50 g of ice assuming heat is only supplied to the ice along the bar, $L_f = 8 \times 10^4$ cal/kg. [4 marks]

b) A resistance thermometer gives readings of 24.9 at the ice point, 29.6 at the steam point and 26.3 at some unknown temperature. What is the unknown temperature on the Celsius scale? [3 marks]

c) Three building materials, plasterboard (k = 0,30 J/(s.m-°C), brick (k = 0.60 J/(s.m-°C), and wood (k = 0.103 J/(s.m-°C), are sandwiched together as the drawing illustrates. The temperatures at the inside and outside surface are 27 °C and 0 °C, respectively. Each material has the same thickness and cross-sectional area. Find the temperature (a) at the plasterboard-brick interface and (b) at the brick-wood interface. [5 marks]



d) A Pyrex glass beaker is filled to the top with 200 cm^3 of mercury at 200 °C. How much mercury will overflow if the temperature of the system is increased to 680 °C?
($\gamma_m = 1.8 \times 10^{-4}$/°C; $\alpha_p = 0.3 \times 10^{-5}$/°C) [3 marks]