January 2014
First Year
First Term
Credit Hours

Faculty of Science
Physics Department

Final Exam
Time 2 Hours
General Physics (1)
Group (A): Heat

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نصف مادة — قسم الفيزياء

Q1) Choose the right answer: **[30 marks]**

Q. no.	Answer		
١	**(a)**	**(b)**	**(c)**
٢	**(a)**	**(b)**	**(c)**
٣	**(a)**	**(b)**	**(c)**
٤	**(a)**	**(b)**	**(c)**
٥	**(a)**	**(b)**	**(c)**
٦	(a)	(b)	(c)
٧	(a)	(b)	(c)
٨	(a)	(b)	(c)
٩	(a)	(b)	(c)
١٠	(a)	(b)	(c)
١١	(a)	(b)	(c)
١٢	(a)	(b)	(c)
١٣	(a)	(b)	(c)
١٤	(a)	(b)	(c)

١٥	(a)	(b)	(c)
١٦	(a)	(b)	(c)
١٧	(a)	(b)	(c)
١٨	(a)	(b)	(c)
١٩	(a)	(b)	(c)
٢٠	(a)	(b)	(c)

Q2) (A) Describe with drawing the principle, construction and working of a Platinum resistance thermometer. **[5 marks]**

---------- **answer** ----------

--Platinum resistance thermometer

It consists of a platinum wire free from impurities doubled on itself to a void induction effects, wound on a thin plate of mica, enclosed in a silica tube. The ends of the platinum wire are attached to platinum leads which pass through holes in mica sheet closely fitting in the upper part of the tube. The free ends P_1 and P_2 of the leads are connected to the terminals at the top of the instrument. In order to eliminate the effect due to variation in the resistance of the leads, similar pair of leads C_1, C_2 with their lower ends joined together are placed close to the platinum thermometer leads as shown in Fig. (4).

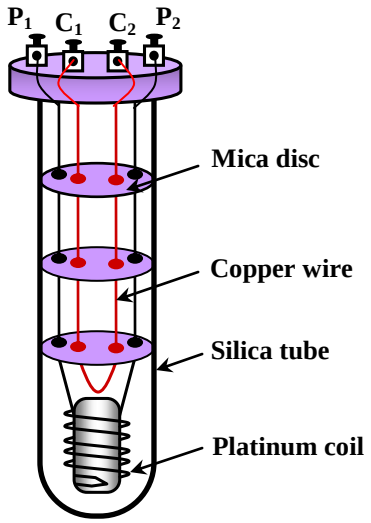

Fig. (4): Platinum resistance thermometer

The platinum resistance thermometer used variation of electrical resistance of platinum wire as a function of temperature that may be expressed by the relation

$$R_T = R_o(1 + \alpha T) \qquad (8)$$

where R_o and R_T are the resistance of a platinum wire at $0\,^oC$ and $T\,^oC$ respectively and α is a constant called as temperature coefficient of platinum wire having a value equal to $0.004\,^oC^{-1}$.

Thus, while using platinum resistance thermometer firstly resistance of platinum wire is measured at $0\,^oC$ and $100\,^oC$ by Wheatstone bridge and then by putting it in the bath whose temperature T is to be measured, the corresponding resistance is measured again by the same bridge. If these readings are R_o, R_{100} and R_T respectively then

$$R_{100} = R_o(1 + \alpha \times 100)$$

and by using the above two expressions one finds

$$T = 100\frac{R_T - R_o}{R_{100} - R_o}\ ^oC$$

The connection of Wheatstone bridge is shown in Fig. (5). The ratio arms P and Q are of equal resistances. The leads P_1, P_2 are connected in the arm S and the compensating leads C_1, C_2 are connected in the arm R. A wire of uniform cross section is inserted as shown in the figure. When the platinum wire is placed in a bath at T^oC, its resistance increases from R_o to R_T. The balance point will then shift towards the side of the platinum thermometer and a new balance point is obtained.

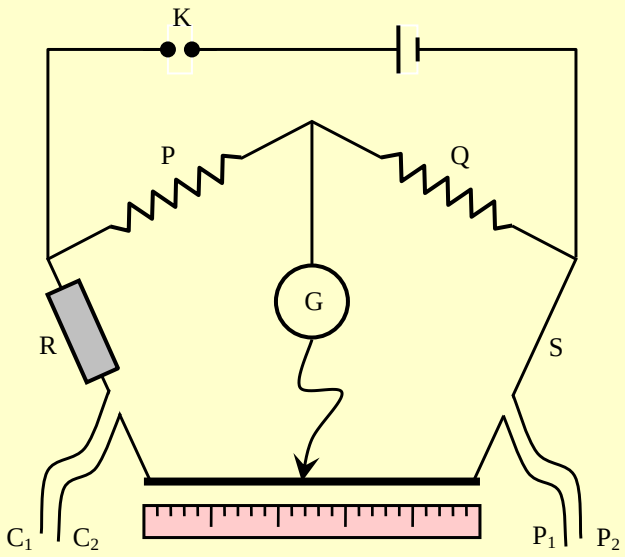

Fig. (5): Wheatstone bridge where P_1, P_2 are connected in the arm S and C_1, C_2 are connected in the arm R

(B) Two hundred thousand joules of heat is removed from a $25\,kg$ block of ice initially at $-5\,^oC$. What is its final temperature? ($c_{ice} = 2110\,J/kg^oC$) **[5 marks]**

---------- **answer** ----------

$Q = -200000 = 2\times10^5\,J$ $\qquad$ $m = 25\,kg$

$T_1 = -5^oC$ $\qquad$ $T_2 = ?$

$Q = mc\Delta T = mc(T_2 - T_1)$

$-2\times10^5 = 25\times2110\times[T_2 - (-5)]$

$T_2 = -8.8^oC$