THE OPEN UNIVERSITY OF SRI LANKA
ADVANCED CERTIFICATE IN LABORATORY TECHNOLOGY
FINAL EXAMINATION-2009/2010
LABORATORY TECHNIQUES IN PHYSICS-PSC 2324

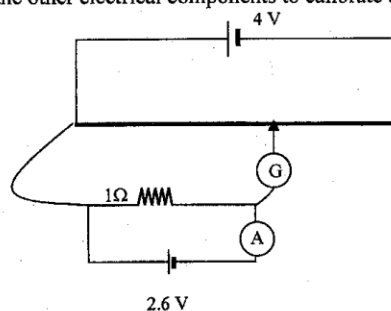**Time Duration: Two hours**

| Date: 6th July 2010	Time: 10.30 a.m. – 12.30 p.m.

Answer **four (4)** questions only

PART B

(1) The following figure shows a potentiometer (length of the wire ,4 m) arrangement
   with the other electrical components to calibrate an ammeter (A).

(i) Find the voltage gradient of the potentiometer.
(ii) At the moment of recording the measurement, what significant event can be
     observed in the circuit.
(iii) At that moment, the position of the key which is attached to the vernier scale on the
      potentiometer wire is enlarged in the following figure.
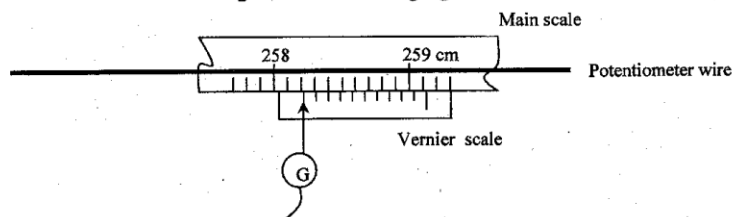
Find the correct current through the 1 Ω resistor corresponding to the above
   situation.
(iv) How do you modify the above circuit to draw the calibration curve for the ammeter?
(v) Explain the advantage of a potentiometer compared to a conventional voltmeter.

(2) (i) What are the types of radiation emitted in a radioactive disintegration?
(ii) When handling radio active sources, give three precautions you take for your personal protection.
(iii) Define the half-life time of a radio active element.
(iv)Use the following equation to derive an expression for half-life ($t_{1/2}$) of radio active element.

$$\text{Activity} = \text{Initial Activity} \times e^{-\lambda t}$$

(v)Calculate the time taken for the activity of Radium source ($t_{1/2} = 5.8$ years) to fall to 20% of its initial activity. (Note: if necessary you can use; log 2 = 0.3)

(3)(i) Complete the following full-wave rectifier circuit, inserting two rectifier diodes, a capacitor and á load resistor.

230 V/ 50 Hz
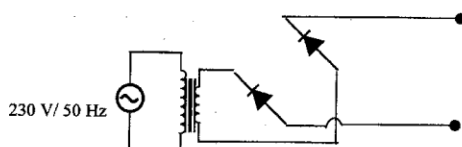
(ii) Sketch the voltage signal variation with the time across the load with and with out a capacitor.
(iii) Sketch the two graphs to compare the voltage signal variation across the load for 100 µF and 1000 µF capacitors.
(iv)Give two usages of the above circuit.
(v) If one diode is burnt in the above circuit, what would be the output voltage pattern across the load ?

(4) (i) Write down the Boyle's law for real gases.

(ii) In the given "U" tube apparatus, a volume of air column is trapped by mercury. The measurements of 'H' and 'h' for two situations are 25 cm and 12 cm respectively. When more mercury is added up to H = 32 cm, the height of the trapped air volume (h) reduced to 11 cm
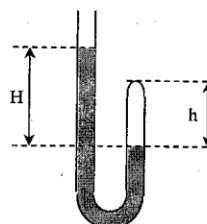
Calculate the atmospheric pressure in Hg cm.

(iii) Now 7 cm of mercury height is removed from the tube and another new liquid .
How height of new liquid is required to maintain the trapped air column without
any changing. (the density of new liquid is 1.2 times mercury) the tube

(iv) When the trapped air region is covered with ice , the level of mercury height at
open tube went down. Explain this observation.

(5).
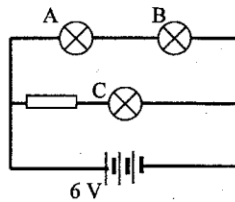
A 6 V dc battery arrangement is connected with three identical electrical bulbs
(3V/0.5W)
(i) Find the current through the bulbs A and B.
(ii) What would be the value of the resistor to be connected with the bulb B to operate
at rated condition ?
(iii) What is the total dissipated power through all the components (bulbs and the
resistor)
(iv) If the battery consists of 1.5 Ω internal resistance what would be the electromotive
force (emf) of the battery to light up the bulbs at rated condition?
(v) Redraw the circuit with an ammeter and a voltmeter to measure the current and
voltage across the bulb C

(6). An electrolytic capacitor (C = 1000 μ) used in a television circuit is subjected to a
dc voltage at 200 V.
(i) Find the amount of charge and the average energy stored in the capacitor
(ii) If this capacitor is connect across a 60 W/ 230 V bulb, what can you observe?
(iii)Draw the graph for the voltage variation with the time across the bulb.
(iv) If this capacitor is connected with sinusoidal voltage signal at 1200 Hz
frequency find the impedance of the capacitor
(v) Draw the diagram of a low pass filter circuit.

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