

**CORK INSTITUTE OF TECHNOLOGY
INSTITIUID TEICNEOLAIOCHTA CHORCAI**

Semester 1 Examinations 2012/13

School: SCIENCE

Programme Title:

Bachelor of Science (Hons) – Analytical Chemistry with Quality Assurance, Year 1

Bachelor of Science (Hons) – Herbal Science, Year 1

Bachelor of Science (Hons) – Nutrition and Health Science, Year 1

Bachelor of Science (Hons) – Pharmaceutical Biotechnology, Year 1

Bachelor of Science – Applied Biosciences, Year 1

Bachelor of Science – Analytical and Pharmaceutical Chemistry, Year 1

Bachelor of Science – Applied Physics and Instrumentation, Year 1

Programme Code: SCHQA_8_Y1

SHERB_8_Y1

SNHSC_8_Y1

SPHBI_8_Y1

SBIOS_7_Y1

SCHEM_7_Y1

SPHYS_7_Y1

Module Title: INTRODUCTION TO PHYSICS (CA)

Module Code: PHYS6011

External Examiner(s): Dr S. Daly

Internal Examiner(s): Dr A. O'Connor

Instructions: Answer **any four** questions. All questions carry equal marks.

Duration: 2 Hours

Sitting: Autumn 2013

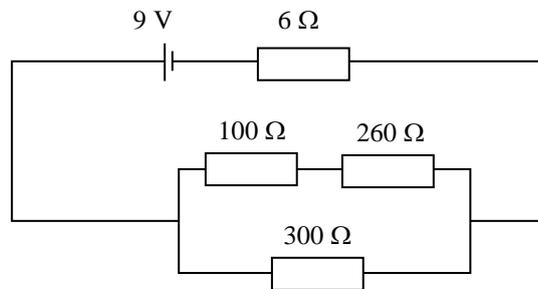
Requirements for this examination: Log tables.

1 **Answer ANY FIVE parts. Each part carries 5 marks.**

- (a) (i) Convert 0.38 mm to m and write your answer in scientific notation.
(ii) State the SI unit for energy and for power.
- (b) For a battery with an emf of 9 V and an internal resistance of 2Ω , calculate the maximum current it can deliver.
- (c) Distinguish clearly between heat and temperature. Explain briefly why there is a lowest possible temperature (i.e., absolute zero).
- (d) Sketch the Maxwell-Boltzmann distribution of molecular energies for two different temperatures, indicating which temperature is higher.
- (e) Explain with the aid of a sketch why the apparent depth of a body when viewed under water is less than its real depth.
- (f) A light ray in water (refractive index 1.33) strikes the surface at an angle of 27° to the normal. At what angle does it emerge into the air?

2 For the following circuit, calculate

- (i) the resistance of the parallel combination; [6 marks]
- (ii) the total current drawn from the battery; [4 marks]
- (iii) the voltage drop across the parallel combination; [4 marks]
- (iv) the current in each branch of the parallel combination; [6 marks]
- (v) the power dissipated in the 300Ω resistor. [5 marks]



- 3 (a) Give three properties of an ideal thermometer, briefly justifying each. [6 marks]
- (b) What is meant by a latent heat? Why is the latent heat of vaporisation always greater than the latent heat of fusion for any substance? [5 marks]
- (c) A container holding 280 g of ice at an initial temperature of -15°C is placed on a hot plate. What power is needed to bring it to a final temperature of 38°C in a time of 6 minutes? (The specific heat capacity of water is $4186 \text{ J/kg}\cdot^\circ \text{C}$ and that of ice is $2300 \text{ J/kg}\cdot^\circ \text{C}$; the latent heat of fusion of ice is $3.3 \times 10^5 \text{ J/kg}$. The heat capacity of the container may be ignored.) [14 marks]

- 4 (a) State the factors which determine the rate of heat flow through a material. The window in a room is 1.5 m high by 90 cm wide. It comprises two panes of glass, each 8 mm thick, separated by 3 mm of still air. If the inside temperature is 22°C and the external temperature is -2°C , calculate the rate of heat loss (or power loss) P through the window. (Relevant thermal conductivities (in $\text{W/m}\cdot\text{K}$): glass, 1.05; air, 0.024.) [13 marks]
- (b) A rectangular oven of sides 80 cm, 90 cm and 1.4 m, with an emissivity of 0.67, is in an environment at 15°C . If the oven is at 180°C , what is the **net** power it radiates into the environment? (Stefan constant: $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2 \text{ K}^4$; absolute zero: -273°C .) [12 marks]
- 5 (a) Explain with the aid of a sketch what happens when light passes through a flat pane of glass. What relevance does this have for ray tracing in lenses? [6 marks]
- (b) Briefly explain what happens to the image when an object is placed at the focus of a convex lens. [4 marks]
- (c) A microscope comprises two convex (focusing) lenses with a separation of 12 cm. The objective has a focal length of 9.5 mm and the eyepiece has a focal length of 10 cm. An object is placed 12 mm in front of the objective. Sketch the formation of the final image (**not to scale!**) and calculate the overall magnification. [15 marks]