

Cork Institute of Technology
Bachelor of Science (Honours) in Herbal Science – Stage 1

(NFQ Level 8)

Autumn 2006

Physics

(Time: 3 Hours)

Instructions
Answer FIVE questions.
Log tables & Periodic table of elements
provided.
 $g = 9.8\text{ms}^{-2}$

Examiners: Ms. C. Devaney
Dr. D. Corrigan
Mr. E. Walsh

- Q1. (a) (i) Define kinetic energy and potential energy and give an example of each.
(ii) Define power and state the SI unit in which it is measured. (8 marks)
- (b) A bus pulls out as a car approaches on an icy street at a speed of 10ms^{-1} (car speed).
Seeing the bus from 26m away, the driver of the car brakes. If the coefficient of friction
between the car tyres and the road is 0.25, how far in front of the bus does the car stop?
(12 marks)

- Q2. (a) Define:
- (i) Torque
(ii) Centripetal force.
(iii) A race car goes around a level circular track with a radius of 1km (kilometre) at a
speed of 33ms^{-1} . Calculate the centripetal acceleration of the car. (8 marks)
- (b) The blades of a fan running at low speed turn at 250rpm (revs min^{-1}). When the fan is
switched to high speed, the speed of rotation increases uniformly to 350rpm in 5.75s.
- (i) Calculate the angular acceleration of the blades.
(ii) Calculate the angle turned through while the fan is accelerating. (12 marks)

- Q3. (a) Write a brief note on heat transfer by radiation. (5 marks)

- (b) The air inside a car has a mass of 2.6kg and a specific heat capacity of $720 \text{ J kg}^{-1} \text{ K}^{-1}$. The driver loses heat at the rate of 120 Joules each second. If all the heat goes into increasing the air temperature, how long will it take for the temperature to change from 21°C to 37°C ? (10 marks)
- (c) In order to design a thermometer, three requirements must be met. List these 3 requirements. (5 marks)

- Q4. (a) (i) Define pressure and give the SI unit in which it is measured.
 (ii) Write a brief note on blood pressure measurement. (8 marks)
- (b) The speed of blood in a main artery, which has a diameter of 1cm is 4.5 cm s^{-1} .
 (i) If the capillary system has a total cross sectional area of $2.5 \times 10^{-3} \text{ m}^2$ calculate the speed of blood through the capillaries.
 (ii) Why is there a need for a low blood speed through the capillaries?
 (iii) With reference to capillary action explain the terms “cohesion” and “adhesion”. (12 marks)

- Q5. (a) Write a brief note on the clinical uses of sound. (8 marks)
- (b) While standing near a railroad crossing, a person hears a train horn. The frequency emitted by the horn is 400Hz. If the train is travelling at 90 kilometres per hour, what is the frequency heard by the bystander (i) when the train is approaching and (ii) when it has passed by?
 Speed of sound in air, $v = 330 \text{ ms}^{-1}$. (12 marks)

- Q6. (a) Explain with the aid of diagrams,
- Refraction of light.
 - Critical angle.
 - Total internal reflection. (6 marks)
- (b) Light passes from air into water. If the angle of refraction is 20° what is the angle of incidence? Refractive index of water, $n_{\text{water}} = 1.33$. (4 marks)
- (c) An object 4cm tall is placed in front of a converging (convex) lens of focal length 22cm.
- Where is the image formed? Comment on the nature of the image.
 - Calculate the image height.
- Assume the object is 15cm from the lens. (10 marks)

- Q7. For the circuit in Figure 1 calculate:
- The total resistance. (6 marks)
 - The current drawn from the battery. (2 marks)
 - The voltage across the 60Ω resistor. (6 marks)
 - the power dissipated in the 15Ω resistor. (3 marks)
 - The energy used if current flows in the 15Ω resistor for 5 minutes. (3 marks)

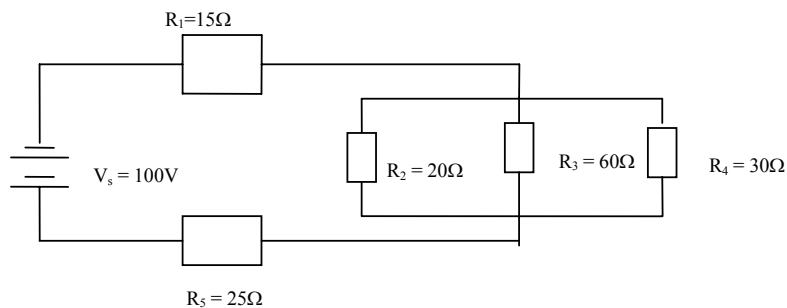


Figure 1

- Q8. (a) By referring to the periodic table of elements, write the nuclear equations for
- (i) The Alpha decay of neptunium -237, (Np)
 - (ii) The Beta decay of phosphorus -32, (P)
 - (iii) The Gamma decay of potassium -42, (K) (9 marks)
- (b) Write a brief note on the underlined radiation in (a) above. (4 marks)
- (c) Describe, with the aid of a diagram, the operation of a Geiger counter. (7 marks)

Table 5.1

HYDROGEN
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8001