THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF JKUAT)

Faculty of Engineering & Technology

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

DEPE 1/DICE I/DTIE I/DEAE I/DMRE I

EEE 2152: PHYSICAL SCIENCE

SUPPLEMENTARY/SPECIAL EXAMINATIONS

SERIES: MAY/JUNE 2012

TIME: 2 HOURS

INSTRUCTIONS:

– Answer any **THREE** questions.
This paper consists of Five printed pages.

QUESTION 1

a) I) Carbon -14 has a decay constant, a = 3.84 x 10^{-12} 5! How long will it take for 99% of a sample of carbon-14 to decay? **(5 marks)**

   II) Explain the use of the following items in a nuclear reactor:
   i)   Control rods
   ii) Moderators
   iii) Coolant **(6 marks)**

b) I) Explain the following terms:
   i)   Nuclear fusion
   ii) Nuclear fission **(4 marks)**

   II) The fusion reaction $4o^1H + 2e^- \rightarrow He + 2V + 6\delta$ ie involves 4 protons (Hydrogen) and electrons to combine and form an alpha particle (He), two neutrinos and six gamma ray s. Given that:
   Mass of hydrogen atom is 1.007825u,
   Mass of Helium atom is 4.0026034u,
   1u = 931Mev
   Calculate the energy released in Mev. **(5 marks)**

QUESTION 2

a) I) Distinguish between:
   i) Transverse and longitudinal waves
   ii) Constructive and destructive interference. **(6 marks)**

II) Figure 2 shows refraction of a light wavefront OA, travelling from water to air, where it emerge as a Wavefront BC. Calculate:
   i)   The speed of light in water
   ii) The angle of refraction, r, in the air, if the angle of incidence in the water was 30°. (Take speed of light in air = 3.0 x 10^8m/s)
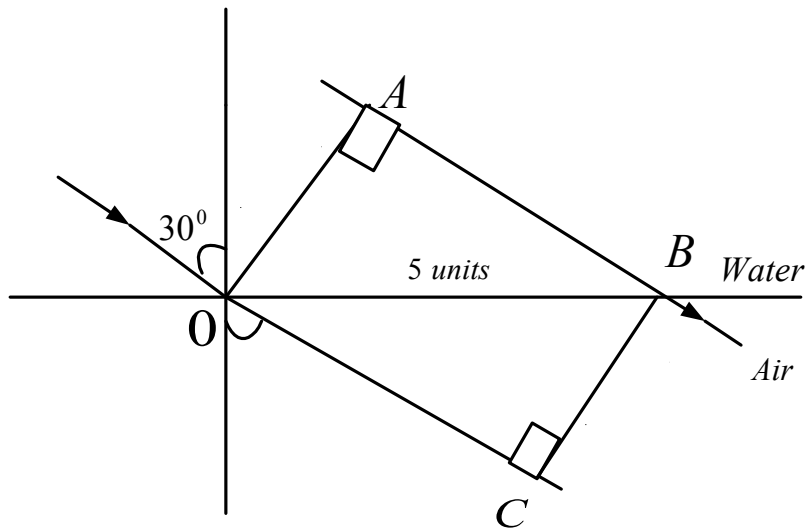
Figure 1

b) I) Explain the term Doppler effect and state any two applications.   **(4 marks)**

   II) A train travelling at 10m/s is sounding a note of 450H$_z$ and approaches a stationery observer and then moves away. Calculate the apparent frequency:
   i)   Towards observer
   ii) Away from observer (Take velocity of sound in air = 340m/s)   **(5 marks)**

QUESTION 3

a) Define the following terms:
   i)   Simple harmonic motion
   ii) Periodic time
   iii) Amplitude
   iv) Frequency   **(4 marks)**

b) A child weighing 10kg is swinging on a simple pendulum of length 3m. If the force due to gravity is 9.8 N/Kg , and the angle of displacement is 30^0, calculate:
   i) Frequency of swinging
   ii) Periodic time
   iii) The restoring force
   iv) Tension on the string   **(8 marks)**

c) I) Define the following terms:
      i) Fundamental frequency
      ii) Harmonics   **(3 marks)**

   II) A vibrating string vibrates with a fundamental frequency of 230 H$_z$ IF The velocity of sound is 330m/s, calculate:
   i)   Wavelength of sound
   ii) The length of the string

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iii) The second and third harmonics of the fundamental frequency.   **(5 marks)**

QUESTION 4

a) I) Define the following terms:
  i) Heat
  ii) Specific heat capacity
  iii) Specific latent heat of fusion   **(3 marks)**

  II) A cup of coffee measuring 200g is at 100^0C. How much will it be cooled, if 50g of ice at 0^0C is added to the coffee?

  (Take specific heat capacity of water = $1cal/gm^0C$, specific latent heat of fusion of ice = 79.7cal/gm   **(5 marks)**

b) I) State the following gas laws:
  i) Charles' law
  ii) Boyles' law
  iii) Pressure law   **(3 marks)**

  II) A bicycle pump holds $60cm^3$ of air when the piston is drawn out. The air is initially at 25^0C and pressure of 120KPa. When the air is forced in, its volume is reduced to $25cm^3$ and temperature rises to 40^0C, Calculate the pressure of air as it is forced into the tyre.   **(4 marks)**

c) I) Explain the kinetic theory of gases.   **(2 marks)**
  II) State any **THREE** assumptions of kinetic theory of gases.   **(3 marks)**

QUESTION 5

a) I) Define the following terms:
  i) Atomic number
  ii) Mass number   **(2 marks)**

II) The element Argon can be represented as $^{40}_{18}Ar$. Write down the number of protons, electrons and neutrons present in an atome of Argon.   **(3 marks)**

b) I) Define the isotope.   **(1 mark)**

II) The table below shows the number of protons and neutrons in elements G, H, I and J (not actual symbols)

Element	G	H	I	J
Number of protons	3	17	19	19
Number of neutrons	4	20	18	22

i) Which of the atoms are isotopes of the same element?
ii) Which atoms have the same mass number?
iii) Write the formula of the compound formed between G and H.   **(4 marks)**

c) i) Define the term electrolysis.   **(1 mark)**

ii) Explain the **THREE** factors affecting the ions selected for discharge during electrolysis.
                                                                                                   (6 marks)
iii) State any **THREE** applications of electrolysis.   **(3 marks)**