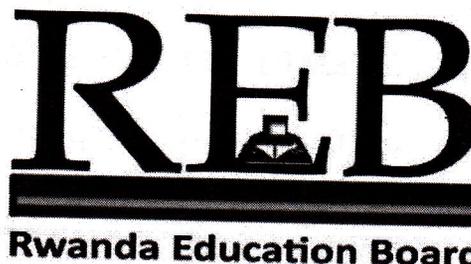


PHYSICS II

030

21/11/ 2018 8.30 AM – 11.30 AM



ADVANCED LEVEL NATIONAL EXAMINATIONS, 2018

SUBJECT: PHYSICS

PAPER II: THEORY

COMBINATIONS:

- PHYSICS-CHEMISTRY-MATHEMATICS (PCM)
- MATHEMATICS-PHYSICS-COMPUTER SCIENCE (MPC)
- PHYSICS-CHEMISTRY-BIOLOGY (PCB)
- MATHEMATICS-PHYSICS-GEOGRAPHY (MPG)

DURATION: 3 HOURS

INSTRUCTIONS:

- 1) Write your names and index number on the answer booklet as they appear on your registration form and **DO NOT** write your names and index number on additional sheets of paper if provided.
- 2) Do not open this paper until you are told to do so.
- 3) This paper consists of **two** sections: **A** and **B**.
 - Section A:** Attempt **ALL** questions. (55 marks)
 - Section B:** Attempt **ONLY THREE** questions. (45 marks)
- 4) Non-programmable scientific calculators and mathematical sets may be used.
- 5) Use only a **blue** or **black** pen.

USEFUL CONSTANTS:

Acceleration due to gravity $g = 9.81 \text{ m/s}^2$

Mass of electron $m_e = 9.1 \times 10^{-31} \text{ kg}$

Electron charge $e = 1.6 \times 10^{-19} \text{ C}$

Mass of electron $m_e = 9.1 \times 10^{-31} \text{ kg}$

SECTION A: ATTEMPT ALL QUESTIONS (55Marks)

- 1) (a) What is meant by the term “planet’s albedo” ? **(1mark)**
- (b) Enumerate any two factors that determine the Earth’s albedo. **(2marks)**
- 2) a) Starting with the smallest, list the following in order of increasing size: Earth, Milky Way, Sun ,Universe. **(1mark)**
- (b) In which galaxy is our solar system located? **(1mark)**
- (c) State any one characteristic of outer planets of the solar system. **(1mark)**
- (d) Name any one inner planet of the solar system. **(1mark)**
- 3) Complete the following statement using the terms: hadrons, mesons strong interaction and baryons.
Particles that interact by the are called
This general classification includes and **(3marks)**
- 4) (a)Name the following signals(figures 1 and 2) using the term digital signal or analog signal.

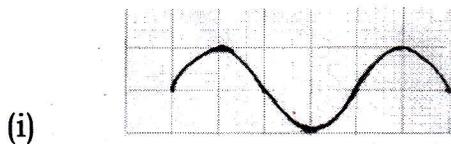


Figure 1 **(1mark)**

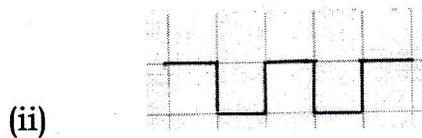


Figure 2 **(1mark)**

- (b) State any one advantage of the digital system of communication. **(1mark)**

5) The basic block diagram of a certain radio receiver is shown below

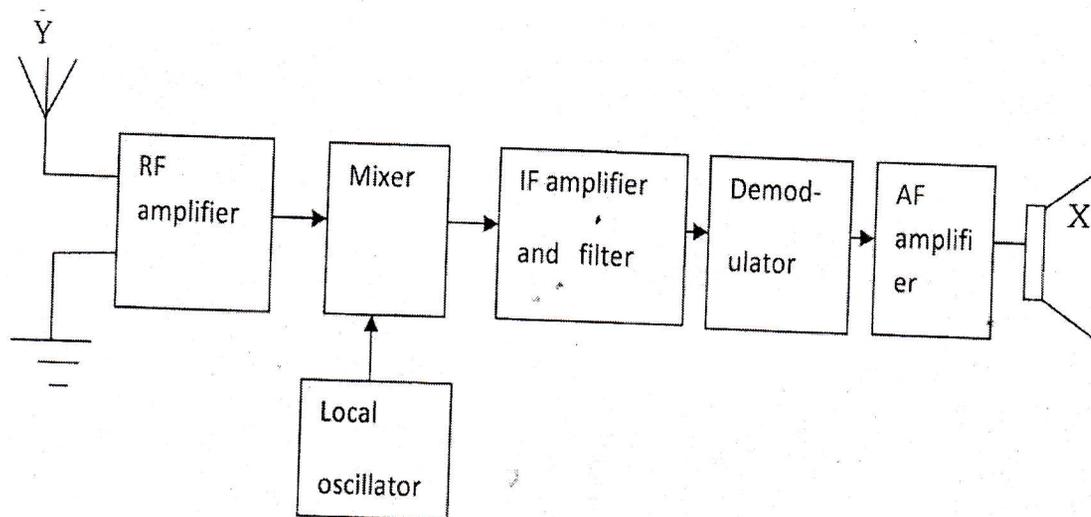


Figure 3

Analyze the above block diagram (figure 3) and identify the component of this radio receiver which performs the following tasks.

- (a) It amplifies audio frequency signals. **(1 mark)**
- (b) It rejects the unwanted mixer output. **(1 mark)**
- (c) It provides the output frequency different from both the incoming signal and intermediate frequencies. **(1 mark)**
- (d) It combines signals at two different frequencies to produce one at an intermediate frequency. **(1 mark)**

6) Complete the missing terms in the blank spaces of the following statements.

- (a) A compound microscope consists of two lenses, an..... (close to the object) and an (close to the eye). **(2marks)**
- (b) In the human eye, a real and image is formed on the light sensitive surface called the **(2marks)**

7) All fossil fuels are non renewable but not all non renewable energy sources are fossil fuels.

- (a) Differentiate between fossil fuel and renewable energy sources. **(2marks)**
- (b) From the list of non renewable energy sources, select one example which is not a fossil fuel. **(1mark)**
- (c) Give any one example of a renewable energy. **(1mark)**

(d) Provide any one fossil fuel.

(1mark)

8) Isochoric process, isobaric process, isothermal process and adiabatic process can be done on an ideal gas.

(a) Explain any one process from the given list, using simple words.

(1mark)

(b) For which process does the work done $W=0$?

(1mark)

c) Identify the process for which the variation of internal energy of a system $\Delta E_{\text{int}} = W$

(1mark)

9) The Compton scattering equation is given by $\lambda' - \lambda = \frac{h}{m_e C} (1 - \cos \theta)$

where h , m_e , C are respectively Planck's constant, electron mass and speed of light in vacuum.

(a) Use the appropriate term to name the physical quantity $\frac{h}{m_e C}$.

Show that this is dimensionally correct.

(2marks)

(b) Is Compton Effect easier to observe with IR, Visible light, UV or X-rays? Justify your answer.

(2marks)

10) (a) One of the postulates of Einstein's theory of special relativity is that the physical laws have the same form in all inertial frame of reference.

Use the appropriate terms to explain the meaning of this postulate.

(2marks)

(b) State another postulate of Einstein's theory of special relativity.

(1mark)

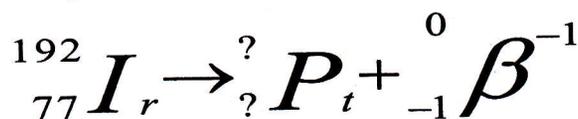
11) Iridium -192 is written using this symbol ${}^{192}_{77}\text{I}_r$

(a) How many neutrons does a nucleus of iridium -192 contain?

(1mark)

(b) When iridium -192 decays, a beta particle is emitted and the iridium changes into platinum.

Complete the nuclear equation that shows this decay.



(2marks)

12) A particle is projected with a velocity of 20 m/s at 30° above the horizontal.

(a) Compute the component V_{oy} of the initial velocity along the vertical axis. (2marks)

(b) Find the time taken by the particle to reach the highest point of the trajectory. (2marks)

13) A 1kg object is supported by a rope of negligible mass attached to the ceiling. Assume that this object is in static equilibrium;

a) draw a free body diagram for this system. (1mark)

b) determine the tension in the rope. (2marks)

14) Analyze the given electrical circuit (figure 4) and determine the currents I_1 and I_2 .

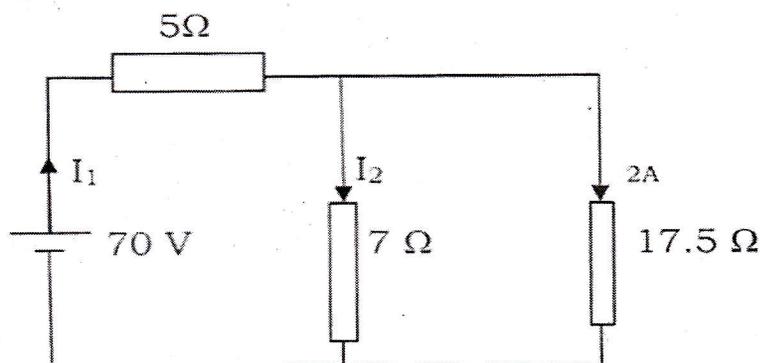


Figure 4

(4marks)

15) A free electron is accelerated in vacuum from rest through a potential difference of 100 V. The gravitational force is neglected.

(a) Find the initial velocity of the electron. (1mark)

(b) Compute the electrical potential energy of the electron. (2marks)

(c) Use the energy conservation to calculate the final velocity of the electron. (2marks)

SECTION B: ATTEMPT ONLY THREE QUESTIONS (45 Marks)

16) (a) Differentiate between Rutherford's atomic model and Bohr's atomic Model. (4marks)

(b) (i) State Bohr's postulates of a hydrogen atom. (3marks)

(ii) Propose any three deficiencies of the Bohr model of a hydrogen atom. (3marks)

(c) The frequency associated with an energy change of a hydrogen atom is 6.166×10^{14} Hz and the final energy level is 4. Determine the initial energy level.

(5marks)

17) Without the use of Physics in the medical field today, diagnosis of problems would be challenging, to say the least. The world of medical imaging in particular has benefited greatly from the use of Physics.

Critically assess the validity of this statement.

(15marks)

18) You are provided with four resistors R_1, R_2, R_3, R_4 characterized by the resistances $2.00 \Omega, 3.00 \Omega, 6.00 \Omega, 11.00 \Omega$ respectively and a battery of electromotive force $\varepsilon = 12.00 \text{ V}$. Assume that the internal resistance of the battery is negligible.

(a) Use the above electric components to design a labelled electric circuit comprising the battery such that the resistors R_1, R_2, R_3 are connected in parallel and the resistor R_4 is connected in series with the battery and in series with the parallel resistor network.

The switch is closed.

(3marks)

(b) Determine the total current flowing through the designed circuit.

(5marks)

(c) Find the voltage across each resistor.

(3marks)

(d) Compute the electric current flowing in each resistor.

(4marks)

19) Discuss as fully as you can the impact of Earthquakes on the environment.

(15marks)

20) A 50 g bob suspended on a string 25 cm long is pulled aside a horizontal distance from the mean position O and then released from rest. The bob of a pendulum moves back and forth along the same path and passes through O as shown (figure 5).

The amplitude of oscillation is 10 cm.

Assume that all external forces are negligible except the gravitational force.

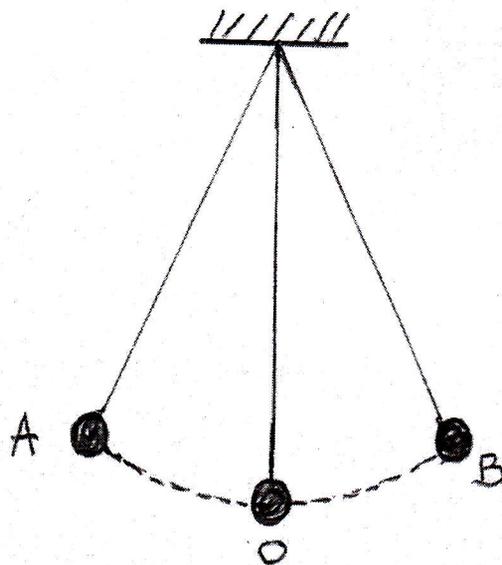


Figure 5

- (a) Compare and contrast between simple harmonic motion and damped oscillatory motion .
- (b) Evaluate the period of this simple pendulum.
- (c) Analyze the above oscillations and suggest the point among the points A, O and B in the path of its swing where the bob suspended on the string is characterized by the following physical quantities:
- (i) the greatest velocity.
 - (ii) the greatest acceleration.
 - (iii) the maximum mechanical energy.
- Prove your answer with the aid of calculation.
- (d) What do you think about the oscillations of the above simple pendulum if all external forces are not neglected?

(4marks)

(2marks)

(2marks)

(2marks)

(2marks)

Use a graph to support your idea.

(3marks)