MINEDUC
RUTSIRO DISTRICT

PHYSICS THEORY

Date:11/03/2024

Period: 9:00 am- 12:00 am

END OF TERM II EXAMINATIONS

GRADE: **S 5**

COMBINATIONS: **PCB, PCM,MPG,MPC**

DURATION: **3 HOURS**

MARKS: **……. /100**

INSTRUCTIONS

This paper is composed of two Sections **A** and **B**

Section A: Attempt ALL questions **(70 marks)**

Section B: Attempt ONLY THREE questions **(30 marks)**

SECTION A: ATTEMPT ALL QUESTIONS (70 MARKS)

1) Choose the best alternative answer for the statements below.

a) Photoelectric effect was explained by (**1 mark)**

(i) Hertz

(ii) Faraday

(iii) Planck

(iv) Einstein

b) The idea of secondary wavelets for the propagation of a wave was first given by (**1 mark)**

(i) Newton

(ii) Huygens

(iii) Maxwell

(iv) Fresnel

c) Which of the following effects was NOT one of the things predicted by the wave theory of light? **(1mark)**

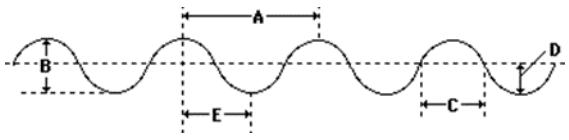
(i) Interference

(ii) Refraction

(iii)Diffraction

(iv)The same wavelength and constant phase difference

d) The amplitude of the wave in the diagram below is given by letter**(1 mark)**



2) Which statement is correct? Answer by True if it is correct and by False if it is not correct.

(a)Stationary/standing wave is the combination of two progressive waves moving in opposite directions, each having the same amplitude and frequency. **(1mark)**

(b)When the particles of a medium are vibrating at right angles to the direction of energy transport, then the wave is longitudinal wave**(1mark)**

(c)Transverse waves are waves in which the displacement of the particles of medium is in the same direction as the direction of propagation of the wave. **(1mark)**

(d)Progressive wave is a wave where continuous energy transfer takes place in elastic medium between the crest and trough (transverse wave) or rarefactions and compressions (longitudinal wave.) **(1mark)**

3) Choose the best alternative that completes the statements below

a) Electric field is a _____ **(1 mark)**

(i) Scalar quantity

(ii) Vector quantity

(iii) Tensor quantity

(iv) Quantity that has properties of both scalar and vector

b) The amount of force exerted on a unit positive charge in an electric field is known as _____ (**1 mark)**

(i) Electric field intensity

(ii) Electric flux

(iii) Electric potential

(iv) Electric lines of force

c) The direction of electric field created by a negative charge is _____**(1 mark)**

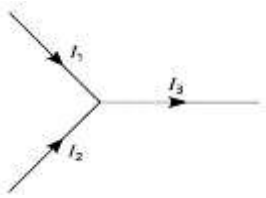
(i) Directed outwards

(ii) Directed towards the charge

(iii) Maybe outwards or towards the charge

(iv) Circular in shape

d) The equation for the currents flowing through the wires based on Kirchhoff's Law is---------- **(1 mark)**



(i) $I_1+I_2+ I_3 = 0$

(ii) $I_1=I_2-I_3$

(iii) $I_1+I_2 = I_3$

(iv) $I_3 = I_1-I_2$

4) Match each of the elements from column A with that from column B (**4marks)**

Column A	**Column B**
(A) $\frac{d^2y}{dt^2} = v^2 \frac{d^2y}{dx^2}$	(1) Resonance
(B) $\frac{d^2y}{dt^2} + \omega^2 y = 0$	(2) free vibration
(C) $\frac{d^2y}{dt^2} + 2k\frac{dy}{dt} + \omega^2 y = 0$	(3) Damped vibration
(D) $\frac{d^2y}{dt^2} + 2k\frac{dy}{dt} + \omega^2 y = F\sin pt$	(4) forced vibration (5) Progressive wave

5) Match each of the elements from column A that from column B (**4marks)**

COLUMN **I**	COLUMN **II**
(A)Motion of a satellite	(1) Damped oscillation
(B)Motion of simple pendulum	(2) Resonant oscillation
(C)Oscillation of a stretched string in air	(3) periodic motion
(D)Flying off of a paper rider placed on the stretched string	(4) Simple harmonic motion

6) According to the theory of black body radiation, A learner of S5 defined a black body as any body that is black.

(a) Do you agree with this definition? **(1 mark)**

(b) If you are agree or not, explain your comment **(4 marks)**

7) Explain any five differences between nuclear fission and nuclear fusion.

(5marks)

8) a) what is meant by fossil fuels? **(1mark)**

b) According to your based personal observation at your home and at school list four environmental consequences of using fossil fuels? **(4marks)**

9)a) i) Write the mathematical expression of Broglie's wavelength **(1mark)**

ii)What is the de Broglie wavelength of a ball of mass 150 g moving at a The speed of 50 m/s? Planck's constant h=6.626 x10^{-34} J.s **(2 marks)**

b) The laser light used in compact disc player has a wavelength of $7.8x10^{2}nm$. Calculate the energy of a single photon of this light

Speed of light is 3x10^{8} m/s **(2 marks)**

10) a) Define the following terms.

(i) Photoelectric effect **(2marks)**

(ii) Threshold frequency **(1mark)**

b) State any two factors affecting photoelectric effect. **(2 marks)**

11) The statements below are about the electrostatic filed, write true(T) if it is correct or false(F) it is wrong**.**

a) The electric field lines are parallel to the equipotential lines**(1mark)**

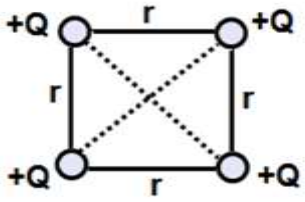
b) The electric field lines are perpendicular to the equipotential line**(1mark)**

c)The electric field lines point in the direction where potential is less**(1mark)**

d)The electric field lines point in the direction where potential is greater **(1mark)**

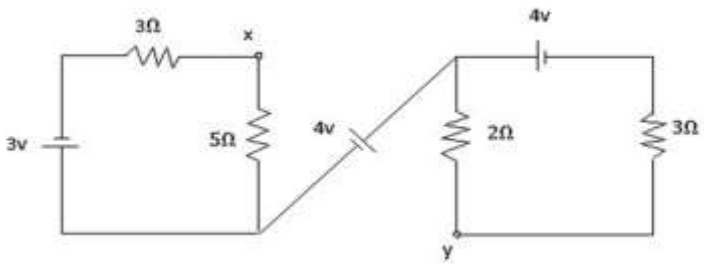
e) The electric field intensity (E) between two oppositely charged plates is given by this expression; $E = \frac{F}{Q}$. **(1mark)**

12) Four positive Q charges are arranged in the corner of a square as shown on the diagram. What is the net electric potential at the centre of the square? **(5marks)**

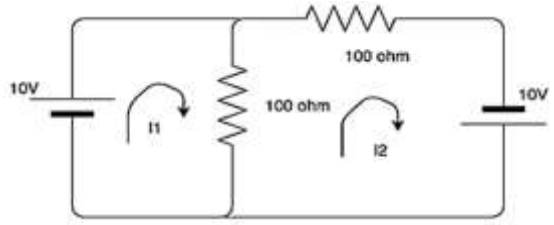


13)a) State the Kirchhoff's laws. **(1mark)**

b) Given the electrical circuit below, find the potential difference between x and y. (**4marks**)

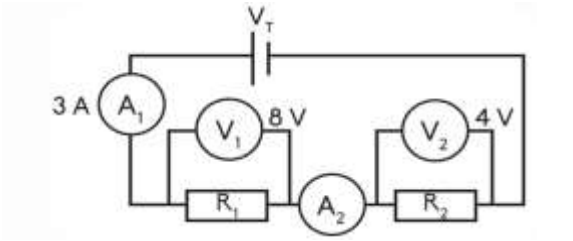


14) a) Find the value of the currents I_1 and I_2. **(1mark)**



A. 0.1, 0.2 B. -0.1, -0.3 C. 0.3, 0.1 D. -0.3, -0.1

b) Study the diagram below and answer the questions that follow:



b) Which measuring instrument in this circuit has a very high resistance? **(1mark)**

c) Calculate: (i) total voltage VT **(1mark)**

(ii) what ammeter A_2 reading? **(1mark)**

d)What will happen to the reading on A1 if another resistor is connected in series? Write only **increases, decreases** or **stays the same**. **(1mark**)

15) a) Sketch graphs to show how each of the following quantities changes during the course of a single complete oscillation of an undamped pendulum: kinetic energy, potential energy, total energy. **(3 marks)**

b)List two examples of situations where resonance is a problem, and where resonance is useful. **(2 marks)**

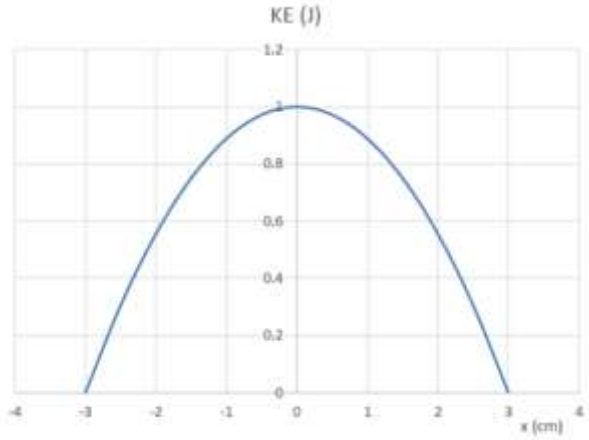
SECTION B: ATTEMPT ONLY THREE QUESTIONS (30 MARKS)

16) Use essay form discuss the risks associated with nuclear power. (**10marks)**

17) a) Outline advantages and disadvantage of Potentiometer **(2marks)**

b) In your own words, Write a short Essay on the principle of the Potentiometer with clear explanation (Do not exceed one page) **(8marks**)

18) A mass 0.4 kg is attached to a horizontal spring which undergoes SHM. The graph of KE as a function of position show below.



a) Draw the graph of total energy as a function of position and the graph of potential energy as a function of position. (**2 marks)**
b) What is the maximum displacement of the oscillating mass? **(2marks)**
c) What is the kinetic energy at the position of 2 cm**? (1 marks)**
d) Find the location of the oscillating mass when its kinetic energy is 0.5 J. **(1 marks)**
e) What is the period of oscillations? **(2 marks)**
f)) What is the potential energy at the position of 2 cm? **(2 marks)**

19) a) State any two Bohr's postulates of a hydrogen atom. (**2marks)**

b) In the Bohr's atomic model, the radius of the electron orbit in a hydrogen atom in the n level is given by $r_n = \frac{\varepsilon_0 h^2 n^2}{\pi m e^2};$

where e is the electron charge, h is the Planck constant, m mass of the electron and ε0 is the permittivity of free space.

(i)Write down the expression for the electric force on the electron orbiting the nucleus and Show that the electric energy of the electron in the n level is given by :

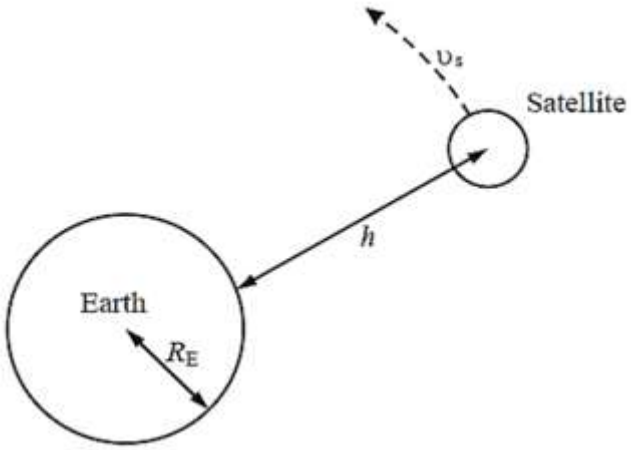
$$E_n = -\frac{me^4}{8\varepsilon_0^2 h^2 n^2}.$$

(**5marks)**

(ii) Calculate the orbital radius in each of the n=1 and n=2 levels. **(3marks)**

20) a) State any four properties of the universal gravitational force.**(2marks)**

b) The diagram (not to scale) shows a satellite of mass m, in circular orbit at speed vs around the Earth, mass ME. The satellite is at a height h above the Earth's) surface and the radius of the Earth is RE.



i) Using the symbols above write down an expression for the centripetal force needed to maintain the satellite in this orbit. (**2marks**)

ii) Write down an expression for the gravitational field strength in the region of the satellite. (**2marks**)

iii) State an appropriate unit for this quantity. **(2marks)**

iv) Use your two expressions to show that the greater the height of the satellite above the Earth, the smaller will be its orbital speed. (**2marks)**

END