PHYSICS II

024

11/03/2024 8:30 AM -11:30 AM

REPUBLIC OF RWANDA

KARONGI DISTRICT

KARONGI DISTRICT COMPREHENSIVE ASSESSMENT

ADVANCED LEVEL 2nd TERM EXAMNATION, 2023-2024

SUBJECT: PHYICS II

PAPER II: THEORY

CLASS: S4

COMBINATIONS:

PHYSICS - CHEMISTRY- BIOLOGY **(PCB)**

PHYSICS - CHEMISTRY- MATHEMATICS **(PCM)**

MATHEMATICS - PHYSICS - GEOGRAPHY **(MPG)**

MATHEMATICS - PHYSICS - COMPUTER SCIENCE **(MPC)**

DURATION: 3HOURS

INSTRUCTIONS:

1) This paper has **TWO** sections: **A** and **B**

   SECTION A: Attempt **ALL** questions **(55 marks)**

   SECTION B: Attempt **ONLY THREE** questions **(45 marks)**

2) You may use mathematical instruments and non-programmable calculator **where necessary**.
3) **Useful constants:**
   Acceleration due to gravity g = 9.81 m/s^2
   Speed of light in vacuum $C=3\times10^8 m/s$

SECTION A: Attempt ALL questions (55 marks)

MULTIPLE CHOICE QUESTIONS from Q1 TO Q 7.

1) Most of the sources of energy we use represent stored solar energy. Which of the following is not ultimately derived from the Sun's energy?

A. Geothermal energy
C. Nuclear energy
B. Wind energy
D. Bio-mass **(2marks)**

2) A bullet hits and gets embedded in a solid block resting on a horizontal frictionless table. Which of the following is conserved? **(2 marks)**

A. momentum and kinetic energy
C. Kinetic energy alone
B. Momentum alone
D. Potential energy alone

3) If an object is in equilibrium, which of the following statements is not true? **(2 marks)**

A. The acceleration of the object is zero.
B. The net force acting on the object is zero.
C. The object must be at rest.
D. There are at least two forces acting on the object.

4) With an astronomical telescope in normal adjustment and used for looking at the moon **(2 marks)**

A. The final image is seen by a relaxed eye
B. The final image of the moon is upright (erect)
C. The objective forms an image of the moon in front of eyepiece focus
D. The final image is seen at the near point of eye

5) A telescope has two lenses which are 124m from each other. The angular magnification of the telescope is 30. The focal lengths of the objective (f_o) and eyepiece of lenses (f_e) are respectively.

A. 12Om and 4m
C. 100m and 24m
B. 4m and 120m
D. 24m and 100m **(2 marks)**

6) What is the value voltage across resistor R_1, when R_1, R_2, R_3 resistors of 5Ω, 10Ω and 15Ω are connected in series with $12V$ of voltage source?

a) 12V b) 21V

c) 10V d) 2V **(2 marks)**

7) An object is in ..... when does not return to its original position after being slightly disturbed.

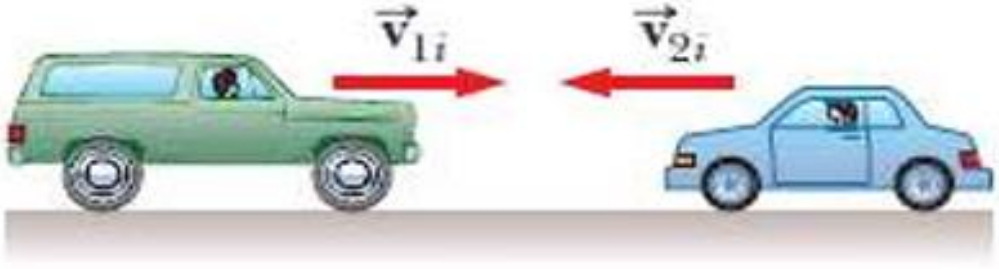
a) unstable equilibrium c) neutral equilibrium

b) stable equilibrium d) none of the given answers **(2 marks)**

8) a) Explain what is meant by a virtual image in geometrical optics? Illustrate your answer by describing the formation of a virtual image of real object by a thin converging lens. Draw a ray diagram showing the passage of two rays through the lens for a non-axial object point. **(4marks)**

b) Explain why such a lens can be used as a simple microscope. **(1mark)**

9) An SUV with mass $1.80 \times 10^3 kg$ is traveling eastbound at $15.0 m/s$ while a compact car with mass is $9.00 \times 10^2 kg$ traveling westbound at $15.0 m/s$. (See Fig. below.) The cars collide head-on, becoming entangled.

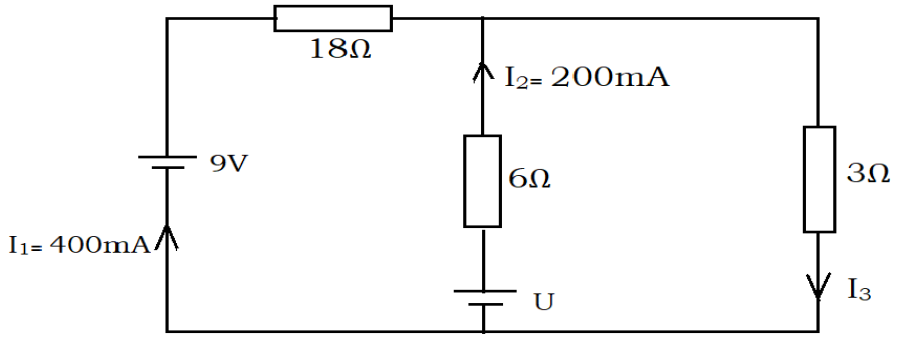


a) Find the speed of the entangled cars after the collision. **(2 marks)**
b) Find the change in the velocity of each car. **(2 marks)**
c) Find the change in the kinetic energy of the system consisting of both cars. **(2 marks)**

10) (a) Differentiate flight time from periodic time. **(2marks)**
(b) A projectile is fired with a speed of $600 m/s$ at an angle of 60^0.
Find:
(i) The flight time. **(1mark)**

(ii) The horizontal range. **(2marks)**
(iii) The time to reach the maximum height. **(2marks)**
(iv) The maximum height. **(2marks)**

11) Analyze the following electrical circuit



Apply Kirchhoff's laws to find:
a) The current I_3 **(2 marks)**
b) The potential difference U **(2 marks)**

12) (a) List at least two examples for each of the following:
(i) Renewable sources of energy. **(2marks)**
(ii) Non-renewable sources of energy. **(2marks)**

(b) Anaerobic digestion is a process in which organic materials like cow dung, agriculture residue or human feaces are digested in the absence of oxygen to produce biogas (methane and ethanol) in the gas tight chamber called digester. There are three principal products of anaerobic digestion; states at least two among them. **(2marks)**

13) (a) Contrast series from parallel electrical circuits. **(2marks)**
(b) Explain why parallel electrical circuits are most preferred at home installations? **(2marks)**

14) A diverging lens has a focal length of 20cm. an object is placed at 30cm in front of the lens. Find:
a) Image position **(2marks)**
b) Magnification of the image formed by this lens. **(2marks)**
c) Any one property of image algebraically. **(1mark)**

15) Why is biogas considered as a good domestic fuel? **(2marks)**

SECTION B: Attempt Only three questions (45 marks)

16) **a)** Humans have changed their view of the world through lenses. Discuss any three benefits of lenses in our daily life **(10marks)**

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

i. A compound microscope consists of two lenses, an……**(1mark)** (close to the object) and an…… (close to the eye) **(2marks)**

ii. In the human eye, a real and…… **(1mark)** image is formed on the light sensitive surface called the …… **(1mark)**

17) a) (i) Explain the difference between the terms angular magnification and linear magnification, as used about optical systems. Illustrate this, by calculating both, in case of an object placed 5.0cm from a simple magnifying glass of length 6.0cm, assuming that the minimum distance of distinct vision for the observer is 25cm. **(4marks)**

(ii) Derive the expression for the magnifying power of a magnifying glass when the final image is formed at the near point. **(5marks)**

b) An object is placed at a distance $f + x$ from a converging lens of focal length f. The lens produces an image at a distance $f + y$ from the lens. Show that $f^2 = xy$. **(6marks)**

18) Mention any eight point that justify the difference between astronomical telescope and compound microscope. **(15marks)**

19) A potential difference V of a dry cell drives a direct current through three resistors R_1 , R_2 *and* R_3 joined in series. The resistance are $2\Omega, 3\Omega$,4Ω respectively.

a) Draw a complete electrical circuit according to the above information including four voltmeters and three ammeters to read electric current passing through every component. **(4marks)**

b) Differentiate *resistor* from *resistance* **(2marks)**

c) If the voltmeter across R_1 reads 4volts, what are the current in R_1? **(2marks)**

d) What do the voltmeters across R_2 *and* R_3 read? **(3marks)**

e) What is the value of V? **(2marks)**

f) Find the resistance of the single equivalent resistor which can replace the resistors R_1 , R_2 *and* R_3 in series **(2marks)**

20) **a)** A point object is moving along a circular path of radius 5cm at the linear speed of $200\pi\ cm/min$, What is the period of this point in seconds? **(2 marks)**

b) A car of mass 2000 kg is turning around a circular path of radius 50m at the constant speed of 36km/h

(i) Express the speed in m/s **(2 marks)**

(ii) What is the centripetal force acting on this car? **(2 marks)**

c) An object is launched at a velocity of 20 m/s in the direction making an angle of 25° with the horizontal. Acceleration due to gravity is 9.81m /s^2. Find

(i) The time required to reach the maximum height **(3 marks)**

(ii) The maximum height reached by the object **(3 marks)**

(iii) The total flight time (between launch and touching the ground) of the object **(3marks)**

END!!!!!!