REPUBLIC OF RWANDA WESTERN PROVINCE RUBAVU DISTRICT	**DISTRICT COMPREHENSIVE EXAMINATION** **SECOND TERM** **SCHOOL YEAR: 2023/2024** **SUBJECT**: PHYSICS II **LEVEL**: SENIOR FOUR (S4) **COMBINATIONS**: PCB, PCM, MPG, PCG PEM	**Date:** **13**/03/2024 **Duration:** 3hrs **Time:** 08:30-11:30 **Max:** **100** Marks

Instructions:

1. **Write your names on your answer sheet.**
2. **This exam has 2 sections A and B.**
3. **Section A: This section is compulsory.**
4. **Choose only three questions from section B.**
5. **Calculators and mathematical instruments may be used.**
6. **Use a blue or black pen for writing.**

Useful constants:

$\frac{e}{m}$= 1.8× 1.8^{11} C/kg

Electric constant K=$9\times10^{9} Nm^{2}.C^{-2}$

The mass of electron $m_e = 9.11x10^{-31}$ *kg*
Planck's constant $h = 6.626x10^{-34}$ *J.s*
Speed of light in vacuum $C=3x10^{8} m/s$
Electron charge $e=1.6x10^{-19}C$
Acceleration due to gravity $g = 9.81\ m/s^2$

SECTION A: ATTEMPT ALL QUESTION (70 marks)

Question 1

Optical instrument used to view things that are far away is

a) Compound microscope b) Simple microscope c) Telescope d)Camera **(1 mark)**

Question 2

Short sightedness/myopia can be corrected using
a) Convex lens b) convex mirror c) concave mirror d) concave lens **(1mark)**

Question 3

A10 kg box is accelerated from 2 m/s to 4 m/s.

Use work energy theorem to find work needed to accelerate the box

a)50 J b)20 J c)60 J d)100 J

(1 mark)

Question 4

What is the method used to produce electricity in hydroelectric power plant?

a) By boiling the water to produce steam

b) By pushing pistons by heat energy

c)By running dynamo by kinetic energy of water

d) By heating chargeable cells **(1 mark)**

Question 5

a) What is meant by the term energy degradation? **(2 marks)**

b) Explain energy transformation in hydropower **(4 marks)**

Question 6

Match each of the following physical quantity with its meaning **(5 marks)**

Physical quantity	**Meaning**
1.Power	a)The capacity for doing work
2.Energy	b)Any interaction that can change the motion of an object
3.Work	c)The rate at which work is done
4.Potential energy	d)Energy transfer that occurs when an object is moved over a distance by a force applied in the direction of the displacement
5.Force	e)Energy possessed by an object because of its position

Question 7

a) What does the term "optical instrument" mean? (**2 marks**)

b. Using a table, provide at least three differences between telescopes and microscopes. (**6 marks**)

Question 8

a) Distinguish between elastic collision and inelastic collision. (**4 marks)**

b) State the work-energy theorem (**2 marks**)

c) Distinguish conservative force from non-conservative force (**2 marks**).

Question 9

Explain the terms below in words as used in electricity

(i) Electromotive force of a battery **(2mark)**

(ii) Resistance of a conductor **(2mark)**

Question 10

State (i) the types of static equilibrium **(3 marks)**

(ii) the conditions of equilibrium of a rigid body. **(2 marks)**

Question 11

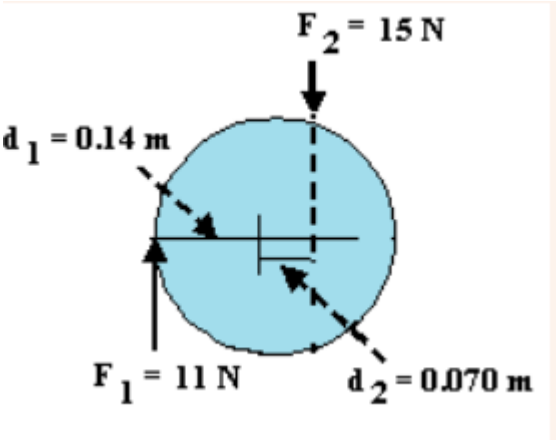
The lens of a digital camera has a focal length of 55 mm and a speed (an f-number) of f/1.8. The correct exposure time for this speed under certain conditions is known to be $\frac{1}{500}$s.

a) Determine the diameter of the lens. **(2 marks)**

b) Calculate the correct exposure time if the f-number is changed to f/4 under the same lighting conditions. **(3marks)**

Question 12

a) A basketball is being pushed by two basketball players during tip-off. Assuming each force acts perpendicular to the axis of rotation through the centre of ball the ball; find the net torque acting on the ball. **(3 marks)**



b. Calculate the linear momentum of the car in the figure below. **(2marks)**

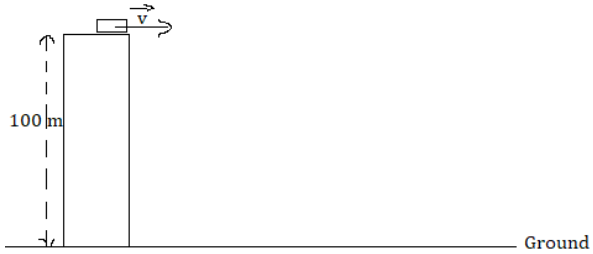


Figure: A car of mass m moves with velocity v

Question 13

A model rocket flies horizontally off the edge of the cliff at a velocity of 50 m/s . The canyon below is 100 m deep.

Acceleration due to gravity g=9.81 m/s^2



a) Determine the time of flight **(3 marks)**

b) How far from the edge of the cliff does the model rocket land?

(3 marks)

Question 14

a) List any two defects of lenses **(1 mark)**

b) An object of height 7 cm is placed at a distance of 25 cm in front of a thin converging lens of focal length 35 cm. Find

(i)the location of the image **(2 marks)**

(ii) the size of the image **(2 marks)**

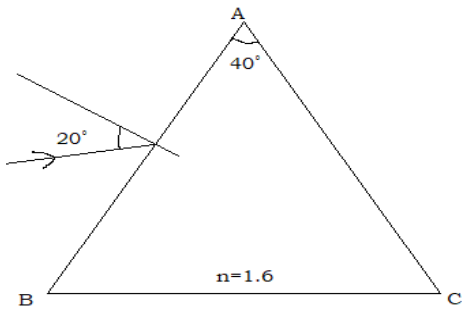
(iii) any two properties of the image **(2 marks)**

Question 15

(i) What do you understand by the term **dispersion of light** by a prism? **(1mark)**

(ii) A triangular glass prism (n = 1.6) is immersed in air (n = 1) as shown in figure below drawn not to scale.

A ray of light is incident on face AB making an angle of 20˚ with the normal.



Find

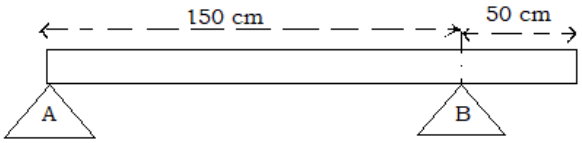
1. The angle of refraction on the face AB **(2 marks)**
2. The angle of incidence on AC **(2 marks)**
3. The angle of emergence **(2 marks)**

SECTION B: ATTEMPT ONLY 3 QUESTIONS (30 marks)

Question 16

A uniform board with a weight of 240 N and a length of 2 m rests horizontally on two supports as shown below.

The support A is under the left end of the board while support B is 50 cm from the right end.



(i)Name the point where the weight of the board is applied **(1marks)**

(ii)Determine the location of the point of application of the weight of the board with respect to the support A. **(2marks)**

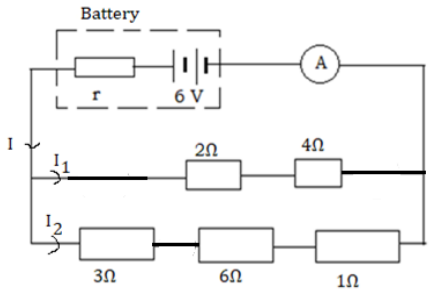
(iii)Draw a free body diagram showing the direction of each of the forces exerted on the board. **(3 marks)**

(iv)Use the conditions of equilibrium of a rigid body to determine the support force F_A and F_B. Take the support point A as a reference point **(4 marks)**

Question 17

Analyze the following electric circuit and then answer the following sub- questions. The battery has emf of 6 V and internal resistance r

The electric current I is 1.5 A.

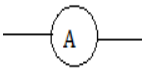


(i)Determine the equivalent resistance of all external resistors **(3 marks)**

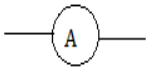
(ii)Find the internal resistance of the battery **(2 marks)**

(iii)Calculate the terminal voltage of the battery **(1 marks)**

(iv)What does the symbol below represent? **(1 mark)**



(v)Observe the given electric circuit then determine the reading of the measuring instrument below



(1mark)

(vi)Determine

1)the current I_1 **(1 marks)**

2)the current I_2 **(1 marks)**

Question 18

Discuss as fully as you can the disadvantages of non-renewable energy. (**N.B: Use essay form)** (**10 marks**)

Question 19

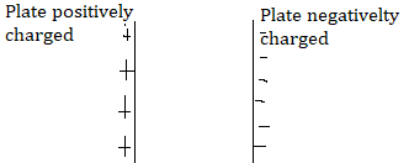
a) Copy and complete the following statements

(i)Unlike electric charges .....each other **(1mark)**

(ii)Like electric charges .....each other **(1mark)**

b) Copy and draw electric field lines due to

(i) Parallel plate capacitor **(2 marks)**

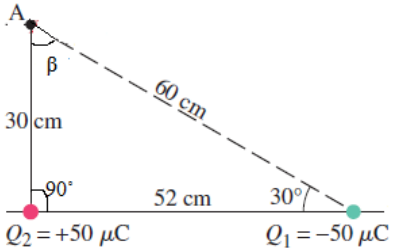


(ii) Electric dipole (a pair of electric charges of equal magnitude but opposite sign separated by a small distance) **(2 marks)**



c) The figure below shows two electric charges Q_1 and Q_2.

Coulomb's constant k =$9x10^9$ Nm^2/C^2



Find

(i)The magnitude of the electric field created by Q_1 at point A

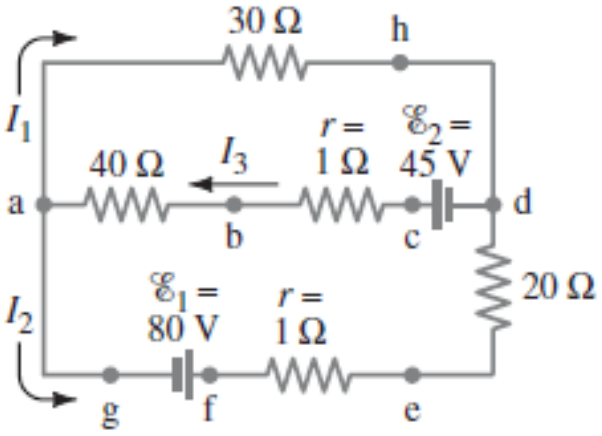
(2 marks)

(ii) Copy the figure and indicate on it the directions of the electric field vectors due to two charges at point A and the direction of the resultant electric field **(2 marks)**

Question 20

a. State the Kirchhoff's rules **(4 marks)**

b. Using Kirchhoff's rules**,** calculate the currents I_1, I_2 and I_3 in the three branches of the circuit in Figure below. (**6 marks)**



BEST WISHES!!!