REPUBLIC OF RWANDA

MUHANGA DISTRICT

END OF THE SECOND TERM EXAMINATION
MARCH 2024

DATE: 18/03/2024

SUBJECT: PHYSICS

CLASS: SENIOR FOUR (S4 PCM, MPG, MPC & PCB**)**

DURATION: 3 hours

MAX: 100 MARKS

INSTRUCTIONS:

1. This paper consists of **two** sections: **A** and **B**.

   Section A: attempt all questions (**70 marks)**

   Section B: attempt only **three** questions. **(30marks)**

2. Non- programmable scientific calculators and mathematical sets may be used.

USEFUL CONSTANT:

Acceleration due to gravity: g =10 m/s^2

SECTION A: ATTEMPT ALL QUESTIONS (70 MARKS)

1. Match each of the following physical quantity with it meaning /**5marks**

Physical quantity	Meaning
1.power	a) the capacity of 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.force	d) Energy transfer that occurs when an object is moved over a distance by a force applied in the direction of the displacement
5.Potential energy	e) Energy possessed by an object because of its position

2. a) What is ***normal adjustment*** of an astronomical telescope? **(1 mark)**

   b) An astronomical telescope has an objective lens of focal length 120 cm and an eye piece of focal length 5 cm. If the telescope is in normal adjustment, what is;

   i) The angular magnification (magnifying power)? **(2 marks)**

   ii) The separation of the two lenses? **(2 marks)**

3. 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. **(2 marks)**
   b) From the list of non-renewable energy sources, select one example which is not a fossil fuel. **(1 mark)**
   c) Give anyone example of a renewable energy. **(1 mark)**
   d) Provide anyone example of fossil fuel. **(1 mark)**
4. 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 of force for this system. **(2 marks)**
   b) Determine the tension in the rope. **(2 marks)**
5. A ball is projected upwards from the top of tower with a velocity 50 ms^{-1} making angle 30^0 with the horizontal. The height of the tower is 70 *m.* After how many seconds from the instant of throwing will the ball reach the ground? **(5 marks)**
6. A stone of 2000kg falls freely from the top of a tower of height H = 200m.
   a) What is the total potential energy and its kinetic energy at height h = H/2? **(2 marks)**
   b) What is the total mechanical energy at this height? **(2 marks)**
7. a) State the work energy theorem. **(2 marks)**

   b) The driver of a 1000 kg car traveling at a speed of 16.7 m/s applies the car's brakes when he sees a red robot. The car's brakes provide a frictional force of 8000 N. Determine the stopping distance of the car. **(4 marks)**

8. a) What is a linear momentum? **(1 mark)**

   b) A 0.04 kg stone and a 0.145 kg baseball have the same kinetic energy. Which has the greatest magnitude of momentum? **(2 marks)**

   c) A 700 N man and a 450 N woman has the same momentum. Who has the greatest kinetic energy **(1 mark)**

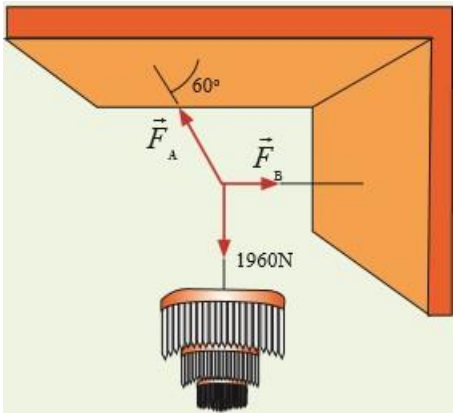
9. a) State the principle of conservation of linear momentum. **(2 marks)**

   b) A car of mass 400*kg* and travelling at 72 *km/h* crashes into a truck of mass 4000*kg* and travelling at 9 *km/h*, in the same direction. The car bounces back at a speed of 18 *km/h*. find the speed of the truck after the impact. **(4 marks)**

10. Calculate the terminal voltage of a battery with an internal resistance of 0.9Ω and an electromotive force 8.5V when the battery is connected in series with an 81Ω resistor. /4marks

11. a) Explain lami's theorem**(2marks**)

b) Calculate the magnitudes F_A and F_B of the tensions in the two cords that are connected to the vertical cord supporting the 200kg chandelier in the figure below. **(4marks)**



12. a) Define energy degradation. **(2 marks)**

    b) A fuel burning power station uses 2000 joules of fuel energy to generate 600 joules of electrical energy. The rest of the fuel energy is wasted as heat.

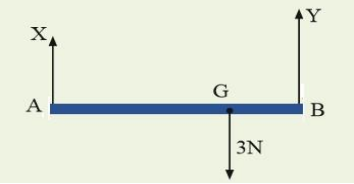
    i. How much fuel energy is wasted as heat? **(2 marks)**

    ii. Calculate the efficiency of the power station. **(2 marks)**

13. A 10 g bullet is fired from a rifle horizontally into a 5 kg block of wood suspended by a string and the bullet gets embedded in the block. The impact causes the block to swing to a height of 5 cm above its initial level. Calculate the initial velocity of the bullet. **(5 marks)**

14. a) Define the moment of force. **(1 mark)**

    b) A horizontal rod AB is suspended at its ends by two strings. (See the figure below). The rod is 0.6m long and its weight of 3N acts at G where AG is 0.4m and BG is 0.2m. Find the tensions X and Y. **(3 marks)**



SECTION B: ATTEMPT ANY THREE QUESTIONS (30 MARKS)

15. a) Give four differences between a compound microscope and an astronomical telescope **(2 marks)**

b) A compound microscope has an eye piece of focal length 2.50cm and an objective of focal length 1.60cm. If the distance between the objective and eye piece is 22.1cm and the final image is formed at infinity. Calculate:

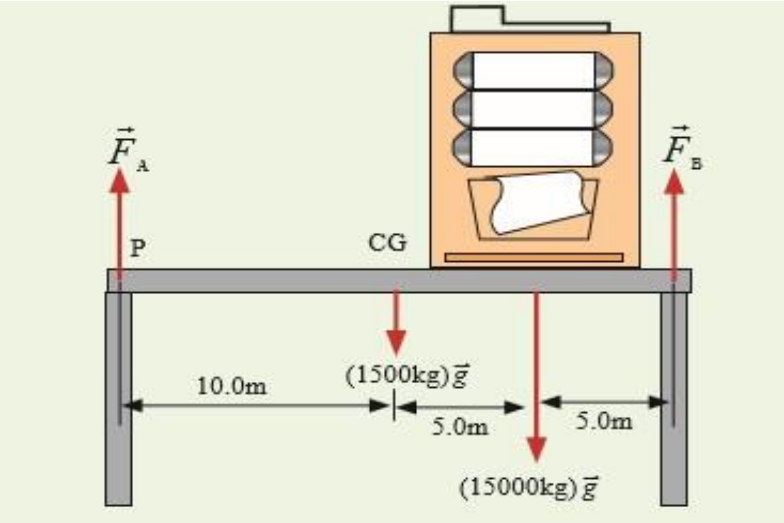
i. The position of the image formed by objective lens **(4 marks)**

ii. The total magnifying power produced **(2 marks)**

c) List down two uses of compound microscope **(2marks)**

16. a) State the conditions under which a rigid body is in equilibrium under the action of coplanar forces. **(2 marks)**

b) A uniform 1500kg beam, 20m long, supports a 15000kg printing press 5 from the right support column, see the figure. Calculate the force on each of the vertical support columns. **(8 marks)**



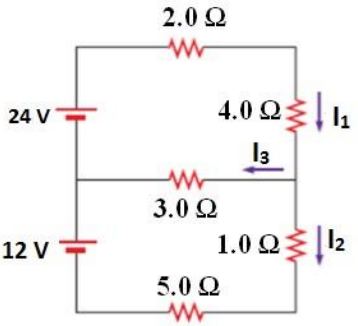
17. a) What is biogas **(2marks)**

b) Give any two Advantages and disadvantages of using biogas energy **(4marks)**

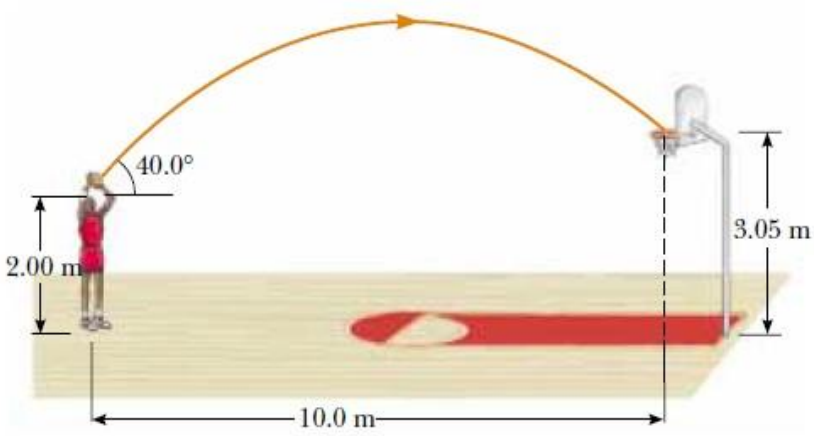
c) Describe any four environmental problems associated with the recovery of fossil fuels and their use in power stations. **(4marks)**

18. a) State Kirchhoff's law of electric current. **(2 marks)**

b) Find the currents I_1, I_2, and I_3 in the circuit shown in Figure below. **(8 marks)**



19. A basketball player who is 2.00 m tall is standing on the floor 10.0 m from the basket, as in figure below. If he shoots the ball at a 40.0° angle with the horizontal, at what initial speed must he throw so that it goes through the hoop without striking the backboard? The basket height is 3.05 m. **(10 marks)**



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