S4 PHYSICS II

March, 2024

8:30 AM – 11:30 AM

NYAGATARE DISTRICT

ADVANCED LEVEL DISTRICT EXAMINATION, TERM II 2024

SUBJECT: PHYSICS

PAPER II: THEORY

COMBINATIONS:

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

DURATION: 3HOURS

TOTAL MARKS: 100

INSTRUCTIONS:

This paper consists of two sections **A** and **B**

1. **Section A:** this section is compulsory. **(70marks)**
2. **Section B:** answer **any three** questions. **(30marks)**
3. Non-programmable scientific calculators, Periodic table of elements and student geometrics instruments (mathematical set) may be used

Take $g=9.81 m/s^2$

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SECTION A: Answer all questions (70marks)

1. An object is placed 8cm in front of a convex lens of focal length 10cm. Find the image distance and the magnification. **(4marks)**

2. Chose the best answer. **(3marks)**

a) Two lenses of power+12 and−2 dioptre are placed in contact. The focal length of the combination is given by:

(i) 8.33 cm

(ii) 12.5 cm

(iii) 16.6 cm

(iv) 10 cm

b) Two small angled prism of refractive indices 1.6 and 1.8 produced same deviation, for an incident ray of light, the ratio of angle of prism

i) 0.88

ii) 1.33

iii) 0.56

iv) 1.12

c) Rainbow is formed due to the phenomenon of

(i) refraction and absorption

(ii) dispersion and focusing

(iii) refraction and scattering

(iv) dispersion and total internal reflection

3. a) What is a far point on an eye? **(1mark)**

b) A particular nearsighted person is unable to see objects clearly when they are beyond 2.5 m away (the far point of this particular eye). What should the focal length be in a lens prescribed to correct this problem? **(3marks)**

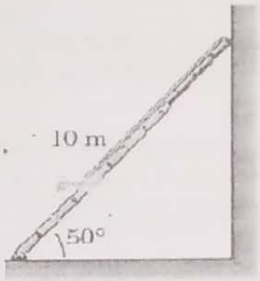
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4. The magnifying power of an astronomical telescope is 8 and the distance between the two lenses is 54cm. The focal length of eye lens and objective lens will be respectively (choose the answer) **(2marks)**

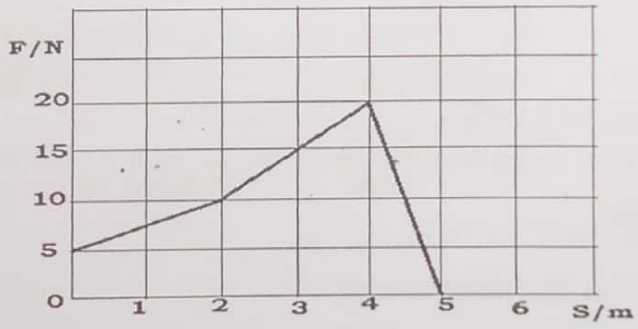
   a) 6 cm and 48 cm
   b) 48 cm and 6 cm
   c) 8 cm and 64 cm
   d) 64 cm and 8 cm

5. a) State two conditions for equilibrium of a body about an axis. **(2marks)**

   b) A uniform ladder 10.0 m long and weighing 50.0 N rests against a smooth vertical wall as in Figure below. If the ladder is just on the verge of slipping when it makes a 50^0 angle with the ground, find the coefficient of static friction between the ladder and ground. **(5marks)**



6. The following graph shows how a force varies with distance as it acts on a mass of 3.0kg, initially at rest.



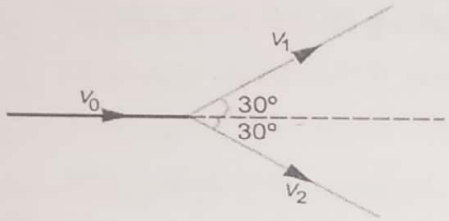
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a) How much work was done by the force in moving the body 5.0m? **(2marks)**

b) Use work-energy theorem to find the speed of the above moving body at 5m. **(2marks)**

7. a) Define the term momentum of an object. **(1mark)**

b) A ball moving with a speed of 9m/s strikes an identical stationary ball such that after collision, the direction of each ball makes an angle 30^0 with the original line of motion (see Fig below).



i) Find the speeds of the two balls after the collision. **(3marks)**

ii) Is the kinetic energy conserved in the collision process? **(2marks)**

8. Four cells of emf 4.5V each and internal resistance 2Ω are combined in series. The combination is connected to an external resistance of 24Ω

a) What is the intensity of the current? **(2marks)**

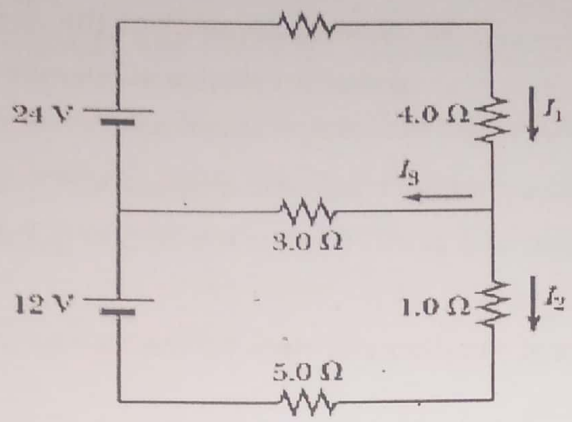
b) Same question if the cells are combined in parallel. **(2marks)**

c) Same question if the combination has two parallel series of two cells each. **(2marks)**

9. a) State Kirchhoff's junction rule. **(2marks)**

b) Calculate each of the unknown currents I_1, I_2, and I_3 for the circuit of figure below **(6marks)**

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10. The range of the motion of a projectile is 20.3 m when it is projected from the ground with a speed of 20m/s What is the maximum height reached? $g = 10m/s^2$. **(4marks)**

11. a) A projectile thrown through an angle of 30° reaches 50m high. Find the initial speed. **(3marks)**

    b) Give any two examples of projectile motion in real life. **(2marks)**

12. Match the correct definition for each vocabulary word **(4marks)**

a. Fossil Fuel	i) A device that moves a magnet near a wire to create a steady flow of electrons.
b. A Generator	ii) An energy source formed from the decomposition of dead organisms.
c. Non-renewable resource	iii) A resource that can be replaced or replenished at a rate equal to or faster than the rate at which it is used.
d. Renewable resource	iv) A resource that exists in finite amounts on our planet and cannot be replenished.

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v) A measurement of the amount of power an electrical current has.

13. An athlete runs around a circular track with a speed of 9.0 m/s and a centripetal acceleration of 3 m s^{-2}. What is the radius of the track? **(3marks)**

14. The wheel of an engine of 4m diameter does 90 rotations per minute. Calculate:
    a) The linear speed. **(2marks)**
    b) The angular speed. **(2marks)**
    c) The centripetal acceleration. **(2marks)**

15. Answer true and false. **(4marks)**
    a. Energy degradation refers to the process by which high-quality energy is converted into low-quality energy.
    b. Energy degradation occurs in all energy conversion processes, leading to a decrease in the overall usefulness of energy.
    c. Friction and resistance are primary contributors to energy degradation in mechanical systems.
    d. Energy degradation can be completely eliminated through efficient energy conversion technologies.

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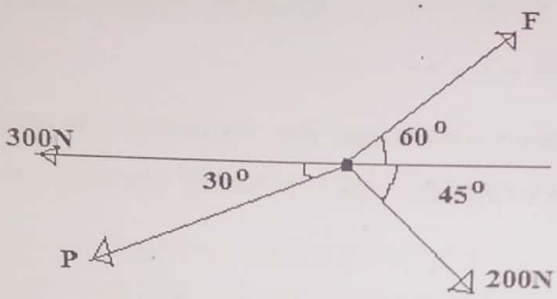
SECTION B: Attempt any three questions (30marks)

16. The body M shown in the figure below is in equilibrium under the action of four forces 300N, 200N, F and P.

    a) Find the x-component of each force. **(4marks)**

    b) Find the y-component of each force. **(4marks)**

    c) Determine the values of P and F, **(2marks)**



17. A projectile is fired with a speed of 600m/s at an angle of 60°. Find:

    a) The horizontal range. **(2marks)**

    b) The maximum height. **(2marks)**

    c) The speed after 30s. **(2marks)**

    d) The speed when the projectile reaches 10km high. **(2marks)**

    e) The time to reach the maximum height. **(2marks)**

18. a) A person sees clearly objects which are near but cannot see objects which are far

        i) What is this eye defect called? **(1mark)**

        ii) How is this eye defect corrected? **(1mark)**

    b) Explain the difference between the angular magnification and linear magnification, as used in optical instruments.

    c) A compound microscope is an optical instrument for forming magnified images of small objects, consisting of two **(2marks)**

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converging lenses at opposite ends both mounted in the same tube.

i. Name two lenses in a compound microscope. **(1mark)**

ii. Which lens in the compound microscope produces an enlarged virtual image of an intermediate image? **(1mark)**

iii. Which lens in the compound microscope forms an enlarged real image of the specimen? **(1mark)**

iv. Sketch a ray diagram of simple microscope which is not in normal use. **(3marks)**

19. a) what is the necessary condition for minimum deviation to occur for a monochromatic light passing through a glass prism? **(1mark)**

b) What happens when a white light ray is incident on a glass prism? **(1mark)**

c) What happens when a monochromatic light ray is incident normally on glass prism? **(1mark)**

d) A prism which has a refracting angle equals 60° and refractive index 1.5 receives a ray at an angle of incidence 45°; calculate:

i) The angle of emergence and **(4marks)**

ii) The deviation of the ray. **(3marks)**

20. a) A projectile is launched with speed V_o at angle θ_o above the horizontal. The launch point is at a height h above the ground. Show that if air resistance is ignored, the horizontal distance that the projectile travels before striking the ground is: $x=\frac{v_0 cos\theta_o}{g}\left(v_0 sin\theta_0 + \sqrt{v_0^2 sin^2\theta_0 + 2gh}\right)$ **(6marks)**

b) Determine x if h is taken to be zero. **(4marks)**

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