NAME	
COMBINATION	
HOUSE	

WEEK 2
TERM ONE 2025
S.6 PHYSICS PAPER TWO
Time: 2hrs: 15minutes
*Answer **all** questions in this paper*

1. a) Define and derive the angular magnification of an optical instrument. *(03 marks)*

b) Describe, with aid of a ray diagram, the operation of a telescope up to a converging and a diverging lens when used in normal adjustment. State one limitation of this type of telescope. *(06 marks)*

c) A telescope consists of a converging and a diverging lens of focal length 1.5m and 0.3m respectively. When it is used to read a scale 15.0cm from the objective. The final image is formed 0.6m from the eyepiece. Find the separation of the lenses. *(04 marks)*

d) Show that the focal length *f* of a converging lens is given by:

$$\frac{\mathbf{1}}{\boldsymbol{f}} = (\mu - 1)[\frac{1}{r_1} + \frac{1}{r_2}]$$

Where μ the refractive index of the material of the lens is r_1 *and* r_2 are the radii of curvature of the surface of the lens. *(05 marks)*

e) Explain why the farthest vertical pole in line with others of equal height looks shorter *(02 marks)*

2. (a) (i) Define the terms **wave front** and **a ray** in reference to a progressive wave. *(02 marks)*

(ii) Draw a sketch diagram showing reflection of a circular wave by a plane reflector. *(02 marks)*

(b) Figure **1** below shows a wave travelling in the positive *x* – direction away from the origin with a velocity of $9ms^{-1}$

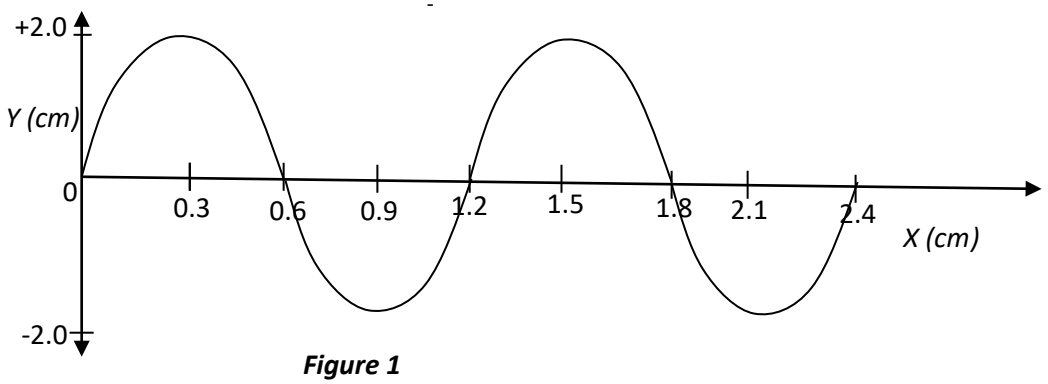

Figure 1

(i) What is the period of the wave? *(02 marks)*

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(ii) Show that the displacement equation for the wave is

$$y = 2\,sin\frac{5}{3}\pi\ (9t - x\ )$$

(03 marks)

c) What is meant by **Doppler Effect?** *(01 mark)*

d) One species of bats locates obstacles by emitting high frequency sound waves and detecting the reflected waves. A bat flying at a steady speed of 5 ms^{-1} emits sound of frequency 78.0 kHz and is reflected back to it.

(i) **Derive** the equation for the frequency of the sound waves reaching the bat after reflection. *(4 marks)*

(ii) Calculate the frequency of the sound received by the bat given that the speed of sound in air is 340 ms^{-1}. *(03 marks)*

e) Explain how interference fringes are formed in an air-wedge film between toe glass slides when monochromatic light is used. *(03 marks)*

3. (a) State the laws of electromagnetic induction. *(02 marks)*

(b) (i) A circular metal disc of radius, r, rotates in an anticlockwise direction at an angular velocity, ω, in a uniform magnetic field of flux density, B directed into paper as shown in **Figure 2.**

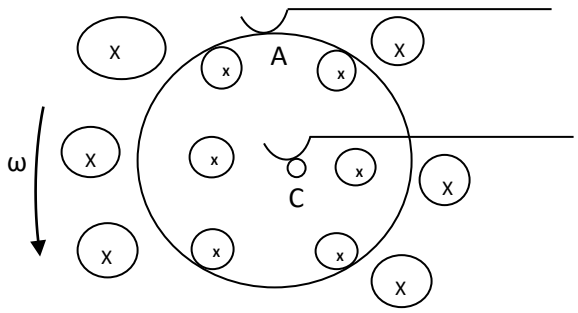

Figure 2.

A and *C* are contact points. Derive an expression for the e.m.f induced between A and C. *(03 marks)*

(ii) A copper disc of radius 10cm is placed in a uniform magnetic field of flux density, 0.02T, with its plane perpendicular to the field. If the disc is rotated parallel to the field about an axis through its center at 3000 revs $min^{-1,}$ calculate the e.m.f. that is generated between its rim and the center. *(03 marks)*

(c) Describe an experiment to demonstrate mutual induction. *(04marks)*

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(e) The diagram in Figure **3** shows the arrangement by which a laboratory balance is critically damped. The aluminum beam supporting the pan moves in the magnetic field of two powerful magnets.

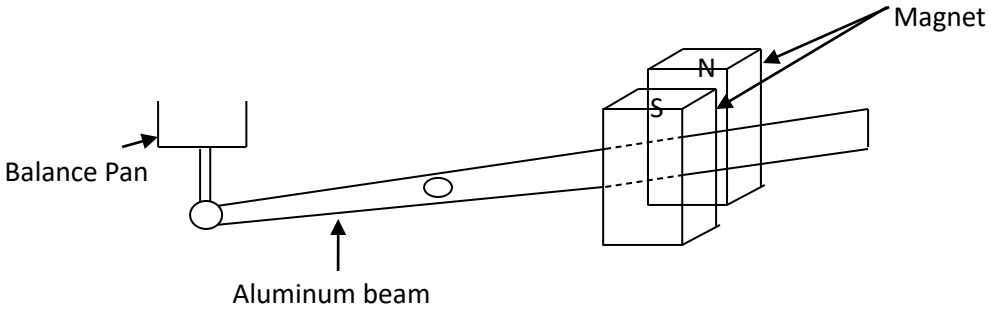

Figure 3.

(i) Explain how damping is caused. *(02 marks)*

(ii) What change would occur in the performance of the balance if the magnets were replaced by weaker ones? *(03 marks)*

(f) (i) Define the **ampere.** *(01 mark)*

(ii) Two parallel wires, P and Q of equal length 0.1cm, each carrying a current of 10A are a distance 0.05m apart, with P directly above Q. If P remains stationery find the weight of P. *(03 marks)*

4. a) What is meant by internal resistance of a battery? *(01 mark)*
   b) In the circuit figure 4, the voltmeter V has a resistance of 400Ω.

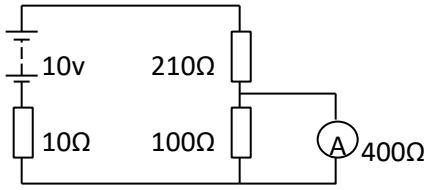

Figure 4

i. Find the reading of the voltmeter *(03 marks)*

ii. Calculate the power dissipated in the 100Ω resistor *(02 marks)*

iii. What voltage would be obtained if the voltmeter was replaced by a cathode ray oscilloscope? *(02 marks)*

iv. Explain the difference between the voltages obtained in i) and iii) above. *(02 marks)*

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c) Explain why in a dynamo, the load resistance is usually bigger than the armature resistance *(03 marks)*

d) Define potential difference and Coulomb *(01 mark)*

e) A particle charge $+4\times 10^{-9}$ is situated between two parallel plates across which a d.c potential difference applied. When the particle is moved 6.0cm against the electric field 8×10^{-5}J of energy is used and the kinetic energy of the particle changes by $6.5 \times 10^{-5}J$.

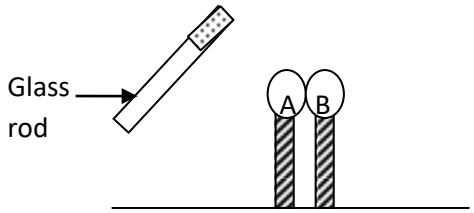
Calculate

i. The work done by the electric field *(03 marks)*

ii. The magnitude of the electric field *(02 marks)*

5. a) Explain how an object gets charged by rubbing. *(03 marks)*

b) Two metal spheres A and B are supported on insulating stands and placed in contact as shown in figure 5.



A glass rod, charged positively, is held close to sphere A. The sphere is then separated while the glass rod is place.

i. State the charge acquired by each of the sphere

ii. Sketch the electric field pattern the sphere *(02 marks)*

iii. Explain how the p.d between the spheres changes as the spheres are moved further apart. *(03 marks)*

c) Describe, with the aid of a labeled diagram, the application of corona discharge in a van der Graff generator. *(05 marks)*

d) Find the resultant electric field intensity at point p, due to charges shown in figure 6 *(05 marks)*

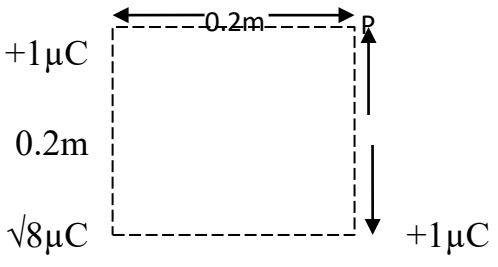


Fig.6

End

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