510/2

PHYSICS

Paper 2

(Theory)

2 hours

END OF TERM 1 COMPETENCE BASED ASSESSMENT

S.5 PHYSICS

(PRINCIPAL SUBJECT)

Paper 2

(Theory)

2 hours 30 minutes.

INSTRUCTIONS TO STUDENTS

This paper consists of **four** *examination items.*

Answer **all** *items.*

Use of relevant diagrams for illustration is highly recommended.

All answers **must** *be written on the answer sheets provided.*

Where necessary take

Acceleration due to gravity g		=	$9.81\ ms^{-2}$
Speed of light in vacuum, c		=	$3.0 \times 10^{8}\ ms^{-1}$
Permittivity of free space ε_o		=	$8.85 \times 10^{-12}\ Fm^{-1}$
The constant	$\frac{1}{4\pi\varepsilon_0}$	=	$9.0 \times 10^{9}\ F^{-1}m$

Item 1

An old man who wanted to shave his bear went to a barber's saloon and was asked to sit in a chair placed at a distance of 2.0m facing a plane mirror. Another plane mirror was placed 6.0m at the back wall directly facing the first mirror. When the old man looked in the plane mirror he could see two images, one of his face and another image of the back of his head and wondered why the images were not one but separated from each other. According to the old man the images seen were real but the barber told him that the images were virtual.

Task : Using your knowledge of reflection of light, help the old man to

(a) understand how the two images were formed.
(b) determine the distance separating the two images seen in the mirror.
(c) understand how the position of the image could be determined in a scientific investigation.
(d) distinguish between real and virtual images.

Item 2

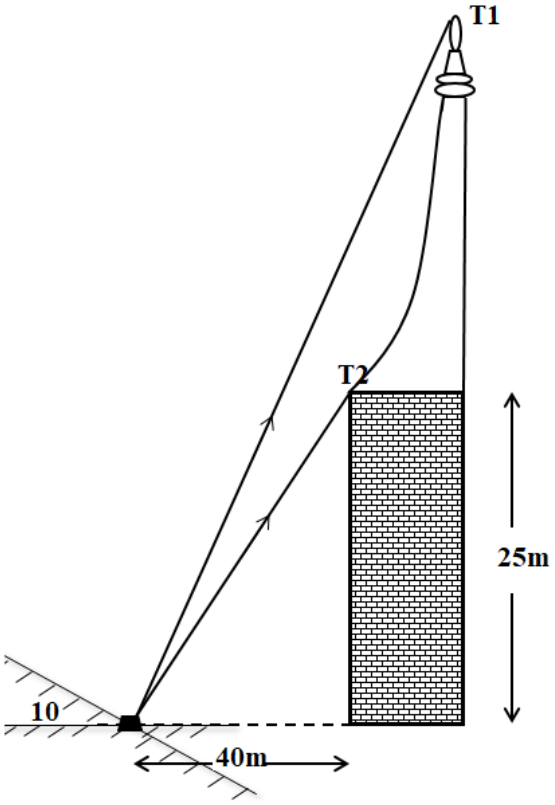
While playing with a ruler by rubbing it in hair a student of S2 realised that thereafter the rule would attract small pieces of paper. When the student rubbed keys in his head, he realized they had no effect on small pieces of paper. The student wondered why two rubbed objects behaved differently.

Task : Using your knowledge of electrostatics

(a) Explain to the student what happened to the ruler when rubbed in hair
(b) Explain why the ruler was able to attract small pieces of paper
(c) Explain why the metallic keys had no effect on the pieces of paper
(d) Describe a scientific investigation that the student would carry out to ascertain the nature of charge on the meter ruler after rubbing it in hair

Item 3:

Tom needs to measure the height of a tower on top of a 25m building in a crowded city. However, the surrounding buildings and narrow streets make it hard to get a direct measurement. To solve this problem, Tom uses the plane mirror method. He sets up a mirror 40m away from the building, initially facing the building directly. Tom adjusts the mirror to reflect a laser beam to the top of the tower (T1). After rotating the mirror 10°, the beam still hits the top of the building (T2). However Tom could not tell the type of reflection used and neither could he describe the nature of the image seen.



Task: Using your knowledge of physics to;

(a) describe the action of an optical instrument that could be used to determine directly the angle of elevation of the top point of the tower

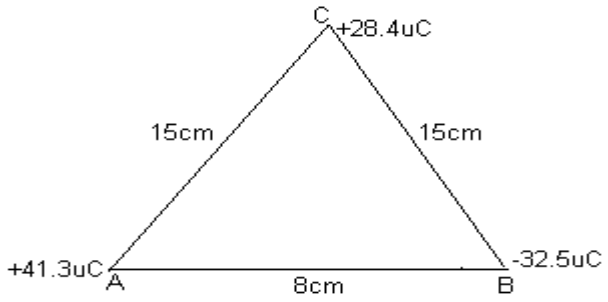
(b) describe the nature of the image seen.

(c) distinguish the type of reflection applied from other types of reflection

(d) determine the tower's height above the ground

Item 4

A business man who imports second hand car and sales them, of recently acquired a garage where the cars can be spray painted so that the cars look good to the customers. Before the garage could start spray painting the cars, the businessman consulted an engineer who told him that during spray painting paint particles repel each other but are attracted to the cars body and wondered if this would not waste the spray paint. The businessman was also told that the body of the car must be earthed during the spray painting. In one of the tests done by the engineer using an electronic microscope it was found that three paint particle from the nozzle of the spray were at one time arranged in a shape of a triangle ABC and carrying charge as shown in the figure below.



Task: using your knowledge of electrostatics, help the business man

(a) understand the law that governs charged particles
(b) know how an electrostatic paint spray works.
(c) determine the electrostatic force experienced by the charge at point C.
(d) understand how the body of car could be charged and yet remains at zero potential

END