INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

HIGHER EDUCATION CERTIFICATE

END OF SEMESTER EXAMINATIONS - DECEMBER 2025

PROGRAMME: HEC
YEAR/SEM: YEAR 1/SEMESTER 1
COURSE CODE: FDN 1106
NAME: FOUNDATION PHYSICS ONE

DATE:
TIME:

INSTRUCTIONS TO CANDIDATES:

SECTION A

Attempt ALL Questions (Each question carries 4 marks)

Question 1:

Define and give examples for the following terms;

a) Fundamental Quantities,

b) Derived Quantities.

Question 2:

a) Define reflection as used in optics and State the two laws of reflection.

Question 3:

a) a) Differentiate between concave mirror and convex mirror

b) b) Briefly outline two importance of convex mirrors

Question 4:

In the kitchen, the cook heats up the milk from 20 °C to 30 °C with the thermal energy of 2000 J. Find the heat capacity of the milk.

Question 5:

How much energy is required to melt 7.00 kg a block of aluminum that is at its melting point? (Latent heat of fusion of aluminum is 380 kJ/kg.)

Question 6:

Use the dimension analysis to derive the dimensions for pressure. Show a clear working.

Question 7:

use the dimension analysis to derive dimensions for density. Show a clear working.

Question 8:

Calculate the effective resistance for 3Ω, 6Ω and 2Ω in parallel with 8Ω resistors in series

Question 9:

A potential difference of 12 V is applied across a conductor whose resistance is 4 ohms. What is the value of current flowing through it?

Question 10:

With the help of clear drawings, differentiate between regular reflection and irregular reflection

Question 11:

A wave of frequency 400 Hz has a wavelength of 2 m. find;

i) The wave speed,

ii) The periodic time.

Question 12:

Water waves travel at a distance of 8m in 4 s. If the distance between two successive crests is 0.02m, find the frequency of the vibrator producing the waves.

Question 13:

a) Define the following terms;

i) Potential difference,

ii) Current.

b) State at least three factors affecting the resistance of a conductor.

Question 14:

a) Explain briefly the meaning of lateral inversion as used in plane mirrors.

b) State at least two characteristics of images formed in plane mirrors.

Question 15:

a)Give two reasons why a convex mirror is preferred as a driving mirror.

b) Identify at least two applications of optics.

Question 16:

An object 3cm tall is placed 10cm in front of a concave mirror of focal length 5cm. Find the position of the image.

Question 17:

What will be the wavelength of a wave that is produced in air and travels at a speed of 200m/s at the frequency of 40,000Hz?

Question 18:

What will be the wavelength of a wave that is produced in air and travels at a speed of 200m/s at the frequency of 40,000Hz?

Question 19:

a)State the ohm's law of electricity.

b) State at least two limitations of ohm's law.

Question 20:

A force of 8 N acts on an object towards the west direction and another force of 6N acts towards the south direction. What is the magnitude of the resultant force?

SECTION B

Attempt any three question (Each question carries 20 marks)

Question 1:

a) i) Define heat energy and state the S.I units

ii) Outline at least two properties of thermometric property

iii) The highest officially recorded temperature in South Sudan was $144^{o}F$ during the month of March. What is this temperature on the Celsius scale?

b) i) Define specific heat capacity and state the S.I units

ii) Explain briefly why water is preferred as a coolant in car engines

iii) A heater rated 4000 W is used for heating the solid of mass 8 kg, if its temperature rises from 20 to 70 degrees In 50 s, find the S.H.C of the solid.

c) i) What is the meaning of latent heat?

ii) Explain briefly why specific latent heat of vaporization is always higher than specific latent heat of fusion

iii) An ice making machine removes heat from water at a rate of 80J/s . How long will it take 4kg of ice at 10 degrees to ice at $0^{o}c$. (S.L.H of ice $=3.36x10^{5}$ and S.H.C of water is 4200J/Kg/K)

Question 2:

a) define the following terms

i. Latent heat of fusion and specific latent heat of fusion

ii. radiation and convection

b) i. Aluminum has a specific heat capacity of 900J/kg/k, what does it mean?

ii. Explain why water is used as a coolant in a radiator of a car.

c) i) Calculate the heat given out when 500g of iron cools from 80^{o}C to 25^{o}C. (S.H.C for iron 460J/kg/K).

ii) Calculate the specific heat capacity of gold if 1400J of heat raise the temperature of 7g of the metal from 0^{o}C to 100^{o}C.

iii) Joel fears taking a bath with cold water. To avoid skin burns, his mother advised him to take a bath when water is at 40^{o}C. If he had 5kg of water in a basin at 90^{o}C.What mass of cold water at 30^{o}C must he add to the hot water to obtain the target temperature as advised by the mother? Neglect heat losses and take specific heat capacity of water to be

Question 3:

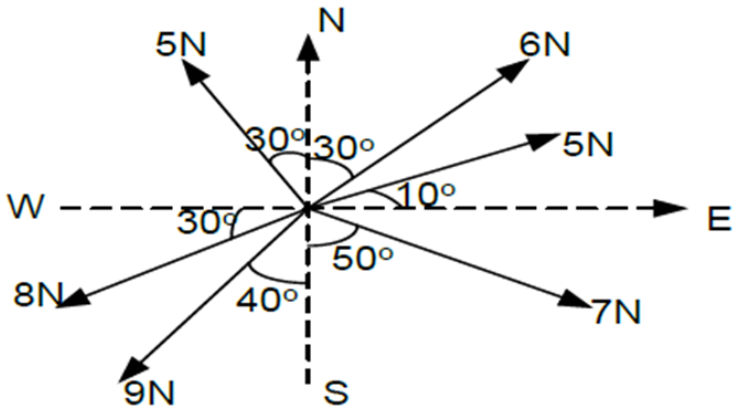
a) i) Define a force and state its S.I units

ii) Briefly explain four effects caused by forces

b) i) Explain the meaning of a resultant a force

ii) Derive the dimensions of a force

c) Forces of 6N, 5N, 7N, 8N, 5N, and 9N act on a particle in the direction N30E, N30W, S50E, W30S, N80E and S40W, respectively. find the resultant force.



Question 4:

) Define the following terms as used in electricity

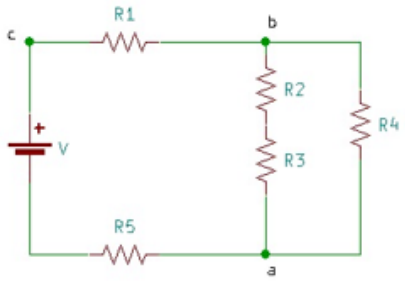
i. Current electricity

ii. Resistance

b) i) State the ohm's law of electricity

ii) State the mathematical relationship of current, voltage and resistance according to ohm's law.

A circuit is constructed with five resistors and a battery as shown. The values for the resistors are $R_1 = R_5 = 44\Omega$, $R_2 = R_3 = 148\Omega$, and $R_4 = 78\Omega$. The battery voltage is V = 12V.



Use the circuit above to find;

i) Total resistance

ii) Total current in the circuit

iii) Power dissipated in resistor R1

Question 5:

(a) Briefly explain the following as applied in heat transfer

i) Conduction

ii) Convection

iii) Radiation

(b) i) With the aid of a well labeled diagram explain briefly how a greenhouse operates.

ii) A gentleman wanted to have a warm bath at 45^{o}C.She had 7kg of water in a basin at 90^{o}C.What mass of cold water at 15^{o}C must she have added to the hot water to obtain his choice of bath? Neglect heat losses and take specific heat capacity of water to be 4200J/kg/K.

(d) Explain briefly how a vacuum flask controls heat loss by Convection, Radiation and Conduction.

Question 6:

(i) What is a wave?

ii) Distinguish between mechanical and electromagnetic waves and state four examples of each.

iii) Classify the following as either transverse or longitudinal waves;

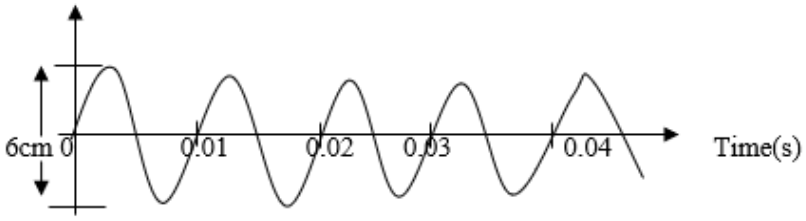
light, ripples, sound waves, and radio waves.

b) Show that the speed V of a wave of frequency f and wavelength λ is given by

.

c) The figure below shows a transverse wave in motion

displacement



i) State the *amplitude* and *period* of the wave.

ii) Given that the wavelength of the wave is 0.5m, calculate the speed of the wave.

d) A popular radio station in Mogadishu broadcasts its signal at a frequency of 88.3MHz. Calculate the wavelength of its signal.

Question 7:

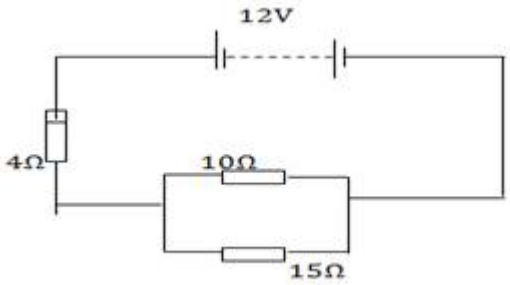
a) State the ohm's law of electricity

ii) State the mathematical relationship of current voltage and resistance according to ohms law.

b) A battery of electromotive force,12V is connected to resistors of

resistances 4 Ω, 10 Ω and

15 Ω as shown below.



i. Determine the effective resistance

ii. Total current in the circuit

iii. The voltage across the parallel connection currents through the 15-ohm resistor.

Question 8:

a) Differentiate between Vector quantities and scalar Quantities and give at least two examples for each.

b) Explain the meaning of dimensions as used in physics.

C) i) State two uses of dimensions in physics.

ii) Prove that $V^2=U^2 + 2as$ is dimensionally consistent given that V=final velocity, U=initial velocity, a=acceleration and S is the distance

iii) The centripetal force required to keep a body of mass moving it a circular path of radius is given by $F = \frac{mv^2}{r}$ show that the formula is dimensionally consistent

d) Use dimensional analysis to show how the velocity of transverse vibrations of a stretched string depends on its length (L) mass (m) and the tension force (F) in the string.

Question 9:

(a) (i) Define refraction and state the laws of refraction of light.

(ii) Give two applications of total internal reflection.

(b) Define reflection and state its laws.

(c) A ray of light incident on glass from air is refracted through 45^o. If the Refractive index of glass is 1.50, find the angle of incidence.

(d) With the aid of a diagram, explain why a swimming pool appears shallower than its actual depth.

(e) An object is placed 30cm from a converging mirror of focal length 20cm. Find the nature, position and the magnification of the image formed.

Question 10:

(a) Define the following as used in electricity

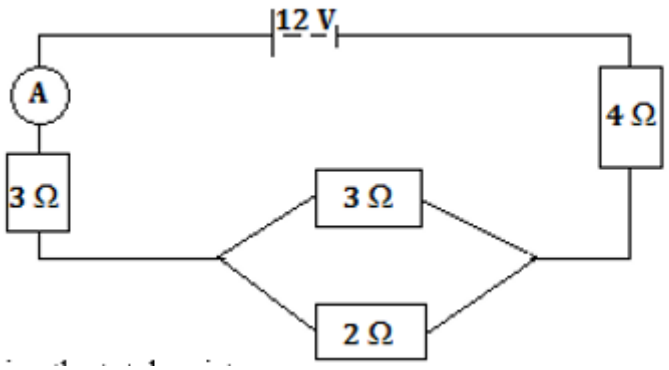
i) Resistivity

ii) Ampere

b)i) With the help of a drawing derive an expression for three resistors in series connection.

ii) Derive an expression for the effective two resistors in a parallel connection

C) Four resistors are connected across a 12V battery, of negligible internal resistance as shown in the figure below.



i. Determine the total resistance

ii. Determine the reading of the ammeter A

iii. Find potential difference across the parallel combination of resistors.

iv. Find the power dissipated in 3 Ohm resistor