INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

HIGHER EDUCATION CERTIFICATE

END OF SEMESTER EXAMINATIONS - APRIL 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:

Differentiate between fundamental quantities and Basic quantities as used in physics. Give at least two examples in each

Question 2:

Identify at least four career opportunities you can pursue after you have studied physics at IUEA

Question 3:

Kenneth pulls on one end of a rope with a force of 200 N, and his Alex friend pulls pulls on the other end with a force of 200 N. What happens to the rope and why?

Question 4:

Find the quantity of heat required to raise the temperature of 500 g of iron by 2◦C, given that the specific heat capacity is 500 J/(kg ◦C).

Question 5:

1.95 kJ of heat is required to raise the temperature of 500 g of lead from 15◦C to its final temperature. Taking the specific heat capacity of lead to be 130 J/(kg ◦C), find the final temperature .

Question 6:

. A 10 cm rod is positioned along the major axis of a concave mirror with a focal length of 10 cm, with its end closest to the pole 20 cm from the mirror. Find the length of the image.

Question 7:

An object is placed in front of a plane mirror at a distance of 0.5 m. Find the distance between object and the image

Question 8:

Use the idea of dimension analysis to express the dimensions for;

i) Force

ii) pressure

Question 9:

Define reflection and state the two laws as used in physics

Question 10:

Differentiate between a concave mirror and a convex mirror and state the importance in each.

Question 11:

Differentiate between longitudinal and transverse waves and state at least two examples in each.

Question 12:

State the ohms law as and the mathematical expression as used in electricity

Question 13:

Find the heat required to raise the temperature of 200g of ice from 0 degrees to 30 degree (s.h.c of water is 4200 J/Kg/k and latent heat of fusion is 3.36 $X10^5 JKg^{-1}$)

Question 14:

a) Define electric power

b) Derive the mathematical expression of electric power

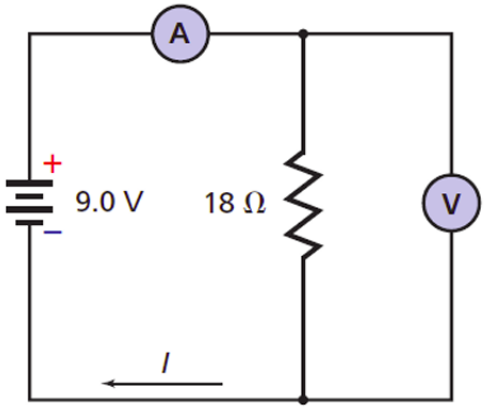
Question 15:

a) Define resistance as used in electricity

b) State at least three factors affecting resistance in a conductor

Question 16:

Consider the circuit diagram below



a. What should the ammeter reading be?
b. What should the voltmeter reading be?
c. How much power is delivered to the resistor?
d. How much energy is delivered to the resistor per hour?

Question 17:

. In a laboratory, bunsen burner is used to increase the temperature of lime from 20 degrees to 70 degrees with the thermal energy of 75,000 J. If the mass of the lime is 30 kg, find the specific heat capacity of the lime.

Question 18:

. An electrical bulb draws 5 A current when connected to a 100-V wall outlet, Find the resistance of bulb.

Question 19:

The frequency of a sound wave is 200Hz and its wavelength is 2 m. What is the speed of the sound waves?

Question 20:

A 3.0 Kg sample of a substance is at its boiling point. If 5,360kJ of energy are enough to boil away the entire substance. What is its latent heat of vaporization?

SECTION B

Attempt any three (Each question carries 20 marks)

Question 1:

a) i) Define basic quantities and derived quantities

ii) Give at least four examples in each case above

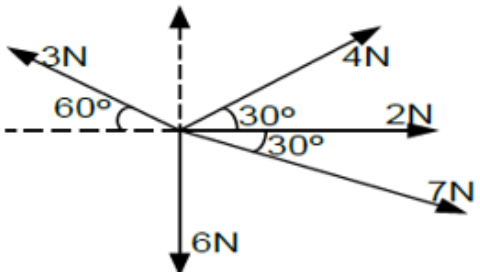
b) Use the dimension analysis to prove the validity of the following equations in physics

i) $S = ut + \frac{1}{2}at$

ii) $V = u + at$

Whereby s- is the distance moved, U- initial velocity, V-final velocity, a – acceleration and t-time.

c) Find the resultant force in the network of forces below



Question 2:

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

iii)Outline at least two properties of thermometric property

iv) The highest officially recorded temperature in Uganda was 134°F during the last 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 2 k W is used for heating the solid of mass 6 kg, if its temperature rises from 30°C to 40°C In 12 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

iv)An ice making machine removes heat from water at a rate of 40J/s. How long will it take 2kg of ice at 20 oc to ice at 0oc. (S.L.H of ice =3.36x105 and S.H.C of water is 4200J/Kg/K)

Question 3:

a) i) Define refraction as used in light

ii) State the two laws of refraction

iii) State what brings about refraction as light travels from one medium to another

ii) A ray of light in air makes an angle of 30 degrees with the surface of a rectangular glass block of refractive index 1.5. What is the angle of refraction?

b) i) With the aid of diagrams, differentiate between regular reflection and irregular reflection.

ii) Calculate the number of images formed by two plane mirrors inclined at angle of 45 degrees

C) i) Define focal length as used in concave mirrors

ii) A small object is placed 20 cm in front of a concave mirror of focal length 15 cm. Find the image distance from the mirror

iii) State at least two uses of a concave lens

Question 4:

a)

a) Define the following as used in electricity

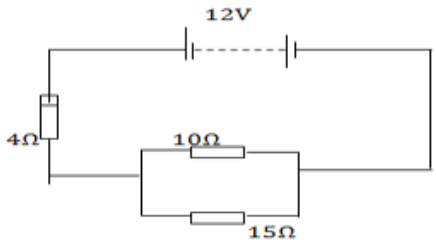
i) Current

ii) Resistance

b) I) Derive the expression for **Power=IV** whereby I is current and V is potential difference

iii) Calculate the power dissipated in a conductor carrying a current of 4 A when a p.d of 12v is connected across its end.

(C) A battery of e.m.f. 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

iv. currents through the 10 ohm and 15 ohms

Question 5:

a) What do you understand by the term amplitude and wave length as applied to wave motion?

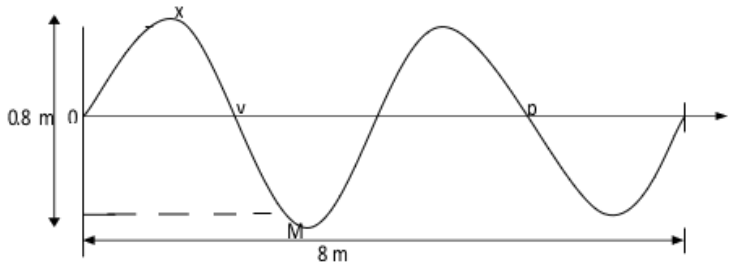
(b)(I) Derive an equation relating velocity V, frequency f, and wavelength λ of a wave

(ii) A local radio station in your area transmits at a frequency of 1500KHz. Calculate its wavelength. (Given the speed of light in vacuum is 3 X 10^8m/s)

(iii) Water waves travel at a distance of 60 cm in 4 s. if the distance apart of a crest is 3 cm, find the frequency of the vibrator producing the waves.

(C)(I) Distinguish between transverse waves and longitudinal waves and give examples each.

d) The diagram below shows a wave travelling in water.



(e) Name (I) Any two points on the wave which are in phase

(ii) Labeled m and x

(iii) Determine the amplitude of the wave.

Question 6:

a) Briefly explain the following as applied in heat transfer

i) Conduction

ii) Convection

iii) Radiation

b) With the aid of a labelled diagram, describe briefly how a vacuum flask works

c) The temperature of a piece of copper of mass 400g is raised to 120oC and it is then transferred to a well lagged aluminium can of mass 20.0g containing 130g of methylated spirit at 20.0oC.Calculate the final temperature after the spirit has been well stirred. Neglect the heat capacity of the stirrer and any losses from evaporation. (Take S.H.C for copper, Spirit and Aluminiun as 400J/Kg/K, 2400J/kg/k and 900J/kg/k respectively)

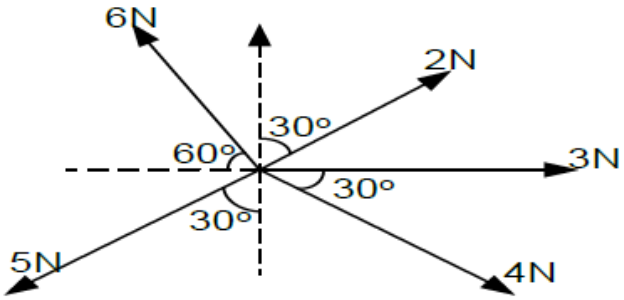
d) Explain briefly how a green house operates

Question 7:

a) i) Define momentum and state the S.I units

ii) State at least two effects caused by a force

iii) Forces of 2 N, 3N, 4N, 5N and 6N act on a particle in the direction of 30 degrees, 90 degrees, 120 degrees, 210 degrees and 330 degrees respectively from the vertical line. Find the resultant force.



b) i) Define dimension analysis

ii) Give two importances of dimension analysis

iii) The centripetal force F acting on a particle moving uniformly in a circle may depend upon mass(m), velocity(v) and radius(r) of the circle. Derive the equation relating the quantities

c) I) Define physics as a science subject

Question 8:

a) Define specific heat capacity and state the S.I unit.

b) Describe an experiment to determine the specific heat capacitor of a liquid by method of mixture.

C) Hot water of mass 0.4kg at 100^0c is poured into calorimeter of mass 0.3kg and specific heat 400kg/kg/k and contains 0.2kg of a liquid at 10^0C. The final temperature of mixture is 40^0c. Determine the specific heat capacity of a liquid.

d) i) Define specific latent heat of vaporization

ii) Explain why specific latent heat of vaporization of water is higher than specific latent eat of fusion.

iii) Calculate the heat required to turn 500g of ice at 0°C into water at 100°C (Specific Latent eat of fusion of ice=340000J/kg and Specific heat Capacity of water=4200J/kg/k)

Question 9:

(a) Define the following as used in electricity

i) Electric energy

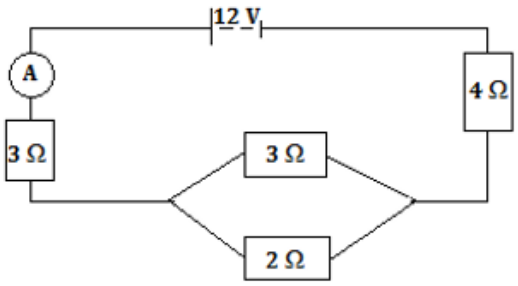
ii) Resistivity

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

ii) Outline at least two sources of electricity in your country of origin

iii) Explain two mechanisms that should be observed while using electricity as source of energy

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



i. Determine the effective resistance

ii. Determine the total current in the circuit

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

iv. Find the power dissipated in 2 Ohm resistor

Question 10:

a) Define a crest and a trough.

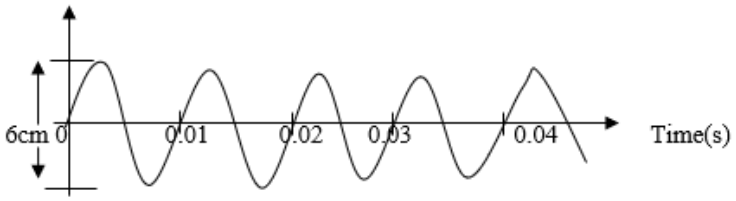
ii) Distinguish between sound and light waves waves and state four characteristics of each

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

light, ripples, sound waves, and radio waves.

b) Derive the general equation of a wave $V = f\lambda$, whereby v=speed of a wave, f=frequency of a wave and lamda is the wave length

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 0.6m, calculate the speed of the wave.

d) A popular radio station in Juba broadcasts its signal at a frequency of 91.13MHz. Calculate the wavelength of its signal.