INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

# HIGHER EDUCATION CERTIFICATE

## END OF SEMESTER EXAMINATIONS - DECEMBER 2025

**PROGRAMME: HEC**
**YEAR/SEM: YEAR 1/SEMESTER 2**
**COURSE CODE: FDN 1209**
**NAME: FOUNDATION PHYSICS TWO**

**DATE:**
**TIME:**

**INSTRUCTIONS TO CANDIDATES:**

## SECTION A

*Attempt ALL Questions (Each question carries 4 marks)*

**Question 1:**

Differentiate between Nuclear fusion and Nuclear fission.

**Question 2:**

Differentiate between a step up transformer and a step down transformer.

**Question 3:**

With the help of drawings, briefly explain the Borh's model of an atom.

**Question 4:**

A capacitor having a capacitance of 5 μF is charged to a potential difference of 10, 000 V. Find the amount charge charged with

**Question 5:**

If a current of 10A passes through a lamp for 5 second Find the number of coulombs of charge passing through the lamp in that time.

**Question 6:**

What is the electric field intensity at a distance of 10 cm from a charge of 7 micro-coulombs placed in a vacuum.

**Question 7:**

What would be the remaining number of 400 atoms of a radioactive substance after 20 hours if the half-life is 4 hours.

**Question 8:**

Find the force between two charges of +7μC and -6μC which are 70cm apart given that $\frac{1}{4\pi\varepsilon_o} = 9 \times 10^9 Fm^{-1}$

**Question 9:**

The figure below shows a network of resistors between P and Q. Find the effective resistance




**Question 10:**

What is the electric field intensity at a distance of 0.3 m from charge of 4 micro coulombs in a vacuum

**Question 11:**

A straight horizontal rod of mass 400g and length 4m is placed in a uniform horizontal magnetic field 2.5T perpendicular to it. Calculate the current through the rod if the force acting on it just balances with its weight.

**Question 12:**

A charge of 2400□ crosses two sections of a conductor in 10 minutes. Find the current through the conductor

**Question 13:**

A transformer has 200 turns of the primary coil. Calculate the number of turns on the secondary coil if 240V is to be stepped up to 400V

**Question 14:**

Briefly explain the domain theory of Magnetism.

**Question 15:**

The electrostatic force between two charges is 24 N. If the distance between them is halved, what will the new force be?

**Question 16:**

A charge of 1 C is placed at a distance of 1 M from another charge of the same magnitude in a vacuum. What is the magnitude of the repulsive force?

**Question 17:**

Three capacitors of capacitance 10 micro farad, 5 micro farad and 20 micro- Farad are connected in series with a 14 V dc supply. Find the charge on 5 micro- Farad capacitor.

**Question 18:**

Two capacitors of capacitance 6 Micro farad and 4 micro- Farad are put in series a cross a 12 V battery. What is the potential difference across the 4 Micro- Farad capacitor?

**Question 19:**

Find the amount of work done in moving a charge of 4 C across two points having a potential difference of 6 V.

**Question 20:**

A 12 V battery is connected across an unknown resistor. If a current of 2 mA is flowing through the circuit. Find the value of the resistance.

## SECTION B

*Attempt any three question ( Each question carries 20 marks)*

**Question 1:**

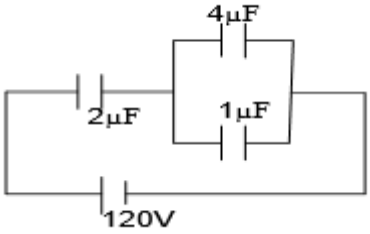
a) I) Define the term a capacitor

ii) A capacitor is charged by a 300V dc supply. When the capacitor is fully charged, it is found to carry a charge of 5.0□□□. □□□ find the;

(i) Capacitance of the capacitor

(ii) Energy stored in the capacitor

b) The diagram below shows a network of capacitors connected to a 120v supply




i) Find the effective capacitance

ii) The charge on 4 μF capacitor

iii) Energy stored in 1μF capacitor

C) I) State coulombs law of electrostatics

ii) Describe briefly how a lightening conductor safe guards a house from the effect of lightning and thunder

iv) Two points charges A and B of 47.0 and 24.0 respectively are placed in vacuum at a distance of 30cm apart. When a third charge C of −35.0 is placed between A and B at a distance of 20cm from A. find the net force on C

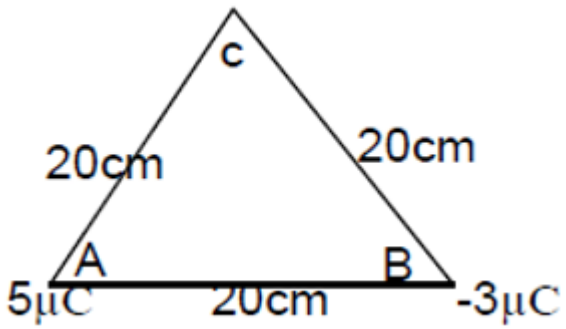
**Question 2:**

a) I) State the coulomb's law of electrostatics

b) I) Two-point charges of 8 and 7 are placed in liquid of relative permittivity 9.0x10 $^{9}Nm^{2}C^{-2}$ at distance 5cm apart. Calculate the force between them.

c) Two-point charges 1, and 2 andare placed at different corners of an equilateral triangle of 20 cm each side. Find the resultant electric field intensity at C

Find the resultant electric field intensity at C



d) Describe briefly how a lightening conductor safe guards a house from the effect of thunder and lightening

**Question 3:**

(a) Define the following terms

i) Half life

ii) Radioactivity

b) Derive the decay equation where N=new number of atoms remaining and $N_o$ =the original number.

c) Derive the relationship between half-life and decay constant

d) The radioisotope $^{60}Co$ decays by emission of a β-particle and ray. Its half life is 5.3 years.

(i) Find the activity of the source containing 1.10g of $^{60}Co$

(ii) What are the differences between β-particle and alpha particle

d) (i) The half-life of a radioactive substance is 10 days. Calculate the mass of the substance which has decayed after 50 days if the original mass is 60g.

**Question 4:**

a) Define the following terms as used in atomic physics

i) Half-life

ii) Radioactivity

b) Explain briefly the Bohr's model of an atom

c) I) Define mass defect

iii) Calculate the minimum energy needed in Mev to make the following reaction happen:

i) - $^{60}_{28}Ni + {}^{4}_{2}\alpha \rightarrow {}^{63}_{30}Zn + {}^{1}_{0}n$

ii) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{146}_{57}La + {}^{87}_{35}Br + 3{}^{1}_{0}n$

Nuclear masses: radium-226 = 225.9771u

Radon-222 = 221.9703 u

Uranium-235 = 234.9934 u

lanthanum-146 =145.8684 u

bromine-87 =86.9153 u

nickel-60 =59.9153 u

zinc-63 =62.9205 u

d) A sample of a radioactive material contains $1 \times 10^{10}$ atoms. The half life of the material is 2.0days. Calculate

(I) The fraction remaining after 5.0days

(ii) The activity of the sample after 5.0days

**Question 5:**

a) State at least 4 properties of magnets

i) Explain briefly how an electromagnet can be made

ii) State three ways how a strength of an electromagnet can be improved

iii) Differentiate between step-up transformer and a step-down transformer

b) An *a. c* transformer is used to provide a voltage of 4000V for operating a T.V tube. If the transformer has 5000 turns on primary and is connected to 240V mains supply. How many turns are in the secondary coil.

c) I) Define the term magnetic flus density

ii) A straight horizontal rod of mass 200g and length 0.2m is placed in a uniform horizontal magnetic field 0.25T perpendicular to it. Calculate the current through the rod if the force acting on it just balances its weight.

**Question 6:**

(a) Define the following terms as used in electricity

i) Resistance

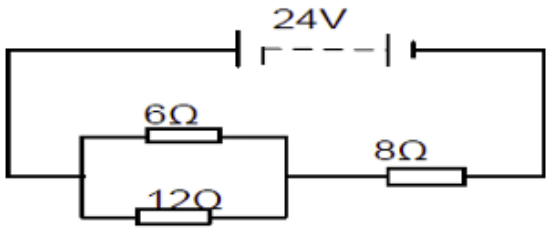
ii) current

(b) (i) Give three renewable sources of electricity in your country.

(ii) Distinguish between a step up and step-down transformer.

(ii) An a.c Transformer is used to provide a voltage of 40000V for operating an ice making machine. If the transformer has 5000 turns on primary and is connected to 240V mains supply. How many turns are in the secondary coil.

c) A *p. d* of 24V from a battery is applied to a network of resistors as shown below




i) find the current through the circuit

ii) find the p.d across the 8Ω resistor

iii) find the current through the 6Ω resistor

**Question 7:**

a) i) State the law of electrostatics

iii) state at least three ways in which a neutral body can be charged

iv) Sketch a labelled diagram of a gold leaf electroscope

v) State at least three importances of a gold leaf electroscope

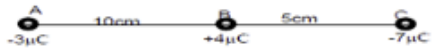
b) i) Explain briefly how you can distinguish a conductor from an insulator using a gold leaf electroscope

iii) Explain briefly how action at sharp points happens.

iv) Explain briefly how lightening takes place

C) i) Find the force between two-point charges $+4\mu C$ and $-3\mu C$ placed 10cm apart

ii) Three-point charges are placed at point A, B and C as shown below




Find the resultant force on the charge at B

**Question 8:**

a) Define the following

i) Ferromagnetic material

ii) Para magnetic material

b) (i) With the help of a drawing, explain briefly how a material can be magnetized by any method of your choice

(ii) Outline at least 4 properties of magnets field line

C) i) With the help of a drawing, explain briefly how an electromagnet can be made

ii) Outline three ways how the strength of an electromagnet can be increased.

d) A conductor of length 12m carrying a current of 2A is placed in magnetic field of flux density 0.125T. Calculate the force on the conductor when placed;

(i) At right angle to the field

(ii) At $80^0$ to the field

(iii) At $70^0$ to the field

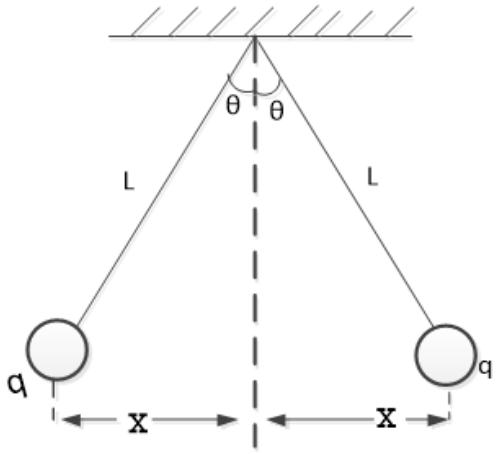
**Question 9:**

a) Define the following terms;

i) Electric potential

ii) Electric field intensity.

(b) Two identical conducting balls of mass, m, are each suspended in air from a silk thread of length, L. When the two balls are each given identical charge, q, they more apart as shown in the figure below.




If at equilibrium each thread makes a small angle θ with the vertical. Show that the separation X is given by;

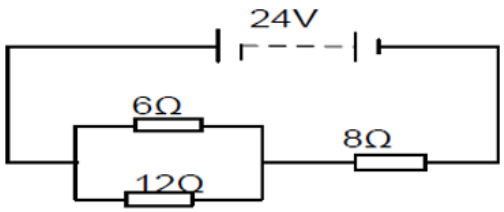
$$X = \left(\frac{q^2 L}{2\pi\varepsilon_o mg}\right)^{1/3}$$

(c) (i) Define an expression for electric field intensity of a charge $Q_2$ placed in air a distance x from another charge $Q_1$.

**Question 10:**

a) Give three renewable sources of mains electricity in your country.
b) Distinguish between a step up and step down transformer.
c) An $a.c$ Transformer is used to provide a voltage of 4000V for operating a machine. If the transformer has 5000 turns on primary and is connected to 240V mains supply. How many turns are in the secondary coil.

d) A $p.d$ of 24V from a battery is applied to a network of resistors as shown below




i) find the current through the circuit
ii) find the p.d across the 8Ω resistor
iii) find the current through the 6Ω resistor