



Faculty of Maritime Sciences  
Department of Navigation  
FOUNDATION PROGRAMME (NAVIGATION)  
INTRODUCTION TO SHIPPING

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FINAL EXAM

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Total Marks: 100%

Date: 10/06/2024

Pass mark: 70%

Time allocated: 2.5 hrs

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- 1) Write short notes on the following types of ships:
  - a) Container ships
  - b) Bulk carriers
  - c) Tankers
  - d) General cargo ships
  - e) Ro-Ro ships

(04 marks each)
  
- 2) Briefly describe the following:
  - a) International maritime organisation (IMO)
  - b) Twenty equal units (TEU)
  - c) Flag state
  - d) Port state
  - e) Flag of convenience

(04 marks each)
  
- 3) Briefly describe the factors and general principles that affect ship design.

(20 marks each)
  
- 4) Describe the uses of the following auxiliary machineries used onboard ships:
  - a) Windlass
  - b) Bilge pump
  - c) Crude oil washing machines
  - d) Derricks
  - e) Mooring winches

(04 marks each)
  
- 5) Describe the duties of:
  - a) Helmsman
  - b) Duty officer during navigation
  - c) Quartermaster
  - d) Watchman at the port

(05 marks each)



Faculty of Maritime Sciences  
Department of Navigation  
FOUNDATION PROGRAMME (NAVIGATION)  
Electronics

FINAL EXAM

Total Marks: 100%

Date: 07/06/2024

Pass mark: 50%

Time allocated: 3 hrs

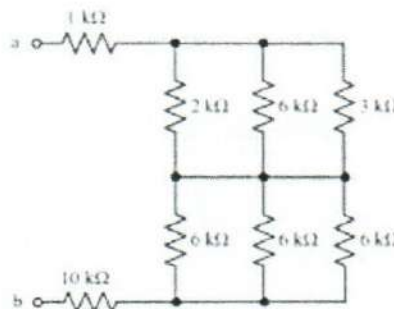
- Answer any 5 Questions

➤ Some helpful Data:

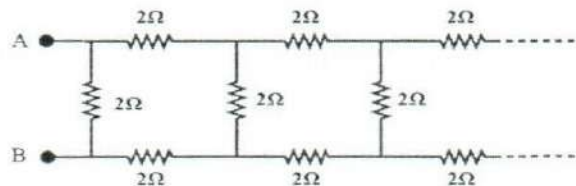
\* Air permittivity  $\epsilon_0 = 8.854 \times 10^{-12} \text{ F} \cdot \text{m}^{-1}$

1.

- a) Define resistance and resistivity. (6 marks)
- b) The resistance of a 20 m length of cable is  $50 \Omega$ . Determine,
- the resistance of 75 m length of the same cable
  - the length of the same wire when the resistance is  $625 \Omega$  (6 marks)
- c) i. Find the equivalent resistance ( $R_{AB}$ ) of following resistor network. (4 marks)

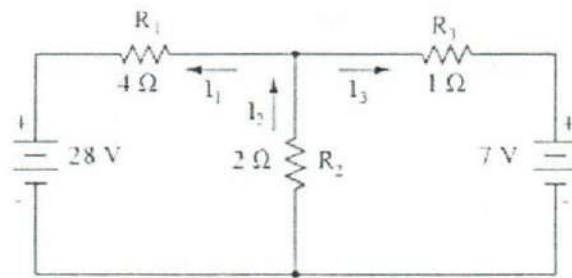


- ii. Evaluate the equivalent resistance ( $R_{AB}$ ) of the following infinite network of resistance. (4 marks)



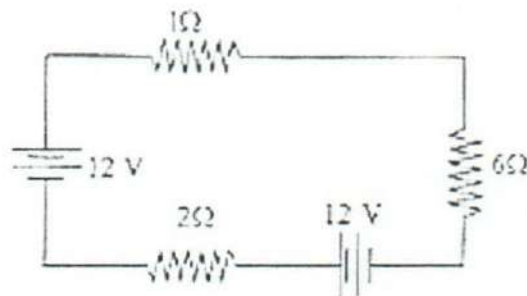
3.

- b) State Kirchhoff's laws (4 marks)
- c) Find the current through each resistor branch using Kirchhoff's laws and hence calculate the voltage across  $4 \Omega$  resistor.



(10 marks)

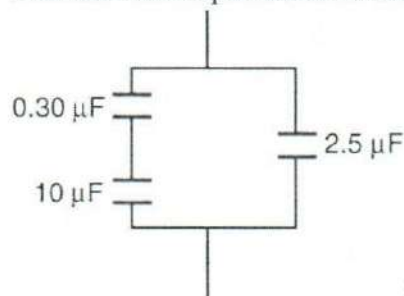
- b) A single-loop circuit contains three resistors and two batteries as shown in Figure (Neglect the internal resistances of the batteries.) Find the current in the circuit.



(6 marks)

4.

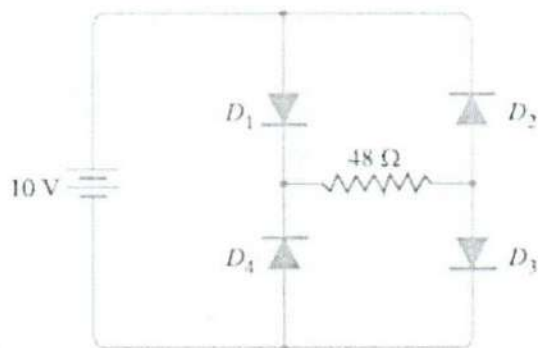
- a) A capacitor is constructed from two conductive metal plates 30cm x 50cm which are spaced 6mm apart from each other and uses dry air as its only dielectric material. Calculate the capacitance of the capacitor (6 marks)
- b) A camera flash tube requires 5.0 J of energy per flash. The flash duration is 1.0 ms.
- What power does the flash tube use while it is flashing?
  - If the flashtube operates at 200V, what capacitance is needed to supply the flash energy? (8 marks)
- c) Find the total capacitance of the combination of capacitors



(6 marks)

5.

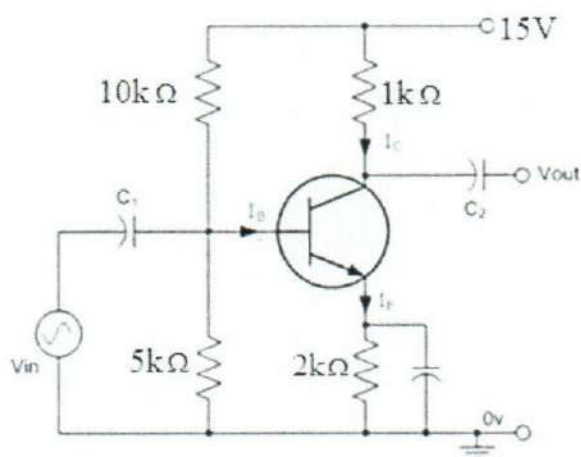
- What is an intrinsic semiconductor? (4 marks)
- What is doping? (4 marks)
- What should be the characteristic of the doping material, if we are to obtain (a) p-type material and (b) n-type material? (6 marks)
- Calculate the current through  $48\ \Omega$  resistor in the circuit shown in Figure. Assume the diodes to be of silicon and forward resistance of each diode is  $1\ \Omega$ .



(6 marks)

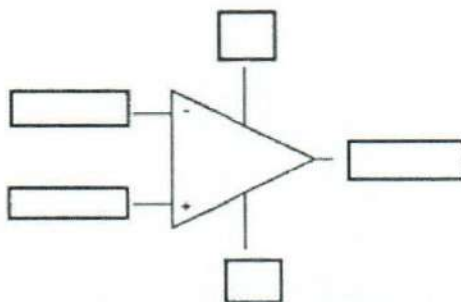
6.

- Draw Schematic diagrams of pnp and npn transistors. (4 marks)
- Draw the circuit diagrams for the various methods of transistor biasing. (6 marks)
- Following is a "Si" transistor biased in common emitter configuration, having  $V_{BE} = 0.7V$ . Determine the operating point. (10 marks)

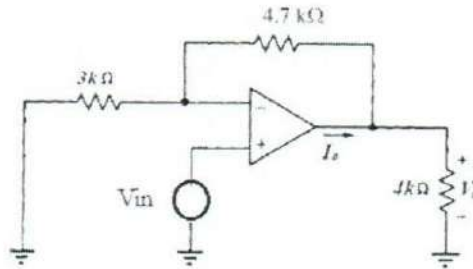


7.

- Identify the terminals in the following op-amp. (04 marks)



- ii. Draw inverting amplifier circuit (04 marks)
- b) A non-inverting amplifier feedback resistance and input resistance are  $4.7\text{ k}\Omega$  and  $3\text{ k}\Omega$  respectively. Determine the gain and output current of following circuit (06 marks)



- c) Draw the circuit diagram of summing amplifier. (06 marks)



CINEC CAMPUS (PVT) LTD.

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET FOUNDATION COURSE

COURSE CODE : ND- 0199, B-024 / ED-0341, B-027

FINAL EXAMINATION – QUESTION PAPER  
**APPLIED MECHANICS**

- Answer any 05 questions only
- Total Marks – 100
- $g = 9.8 \text{ ms}^{-2}$

Date: 06.06.2024

Pass mark 50%

Time allocated: 2.5 Hours

1.

- a) Define Path and Displacement (2× 2= 4 marks)
- b) A car is travelling along a straight lane 20 m/s when the driver sees a tractor blocking the lane 30 m ahead. The car's brakes can produce a retardation of  $5 \text{ m/s}^2$ . With what speed does the car hit the tractor? (4 marks)
- c) A car travelling along a straight road passes point A when  $t=0$  and maintains a constant speed until  $t=24$  seconds. The driver then applies the brakes and the car retards uniformly to rest at point B. Before the brakes were applied the car had travelled  $4/5$  of the total distance AB. Sketch the speed-time graph for the journey and calculate the time taken for the car to travel from A to B (12 marks)

2.

- a) Write 3 examples of circular motion? (6 marks)
- b) A car travels at a constant speed of 13.4 m/s on a level circular turn of radius 50.0 m. What minimum coefficient of static friction,  $\mu_s$ , between the tires and roadway will allow the car to make the circular turn without sliding? (6 marks)
- c) A mass of 2.0 kg, which may be considered to be a point mass, is attached to a string of length 0.3 m and is rotated at  $8.0 \text{ rad / s}$ .
- i. Calculate the moment of inertia of the mass about the axis
  - ii. Calculate its angular momentum. (8 marks)

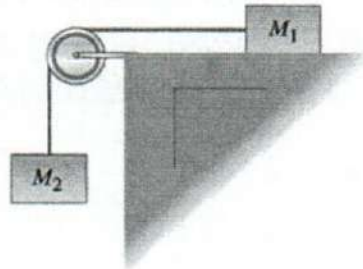
3.

a) Write the Newton's first law of motion.

(4 marks)

b) The two masses of the system shown in the figure are  $M_1 = 6 \text{ kg}$  and  $M_2 = 10 \text{ kg}$ . You may assume that the string is inextensible, coefficient of kinetic friction between the crate and the floor is 0.25 and the coefficient of static friction is 0.3 and the pulley is a mass less smooth one.

- i. Find the limiting friction force
- ii. Find the acceleration of the system.



iii. Find the tension of the system.

(8 marks)

c) State conservation of energy

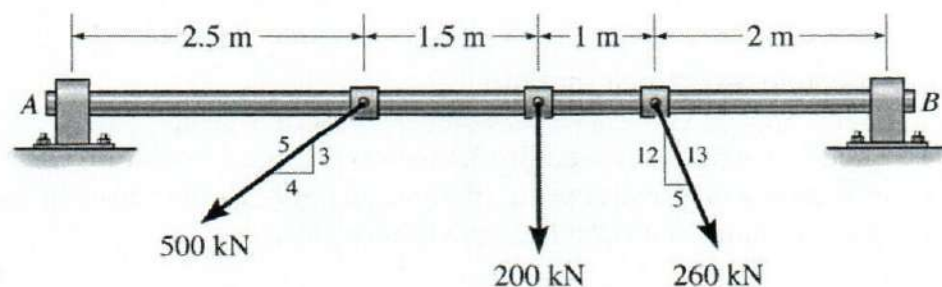
(3 marks)

d) What are the advantages and disadvantages of using solar energy ?

(5 marks)

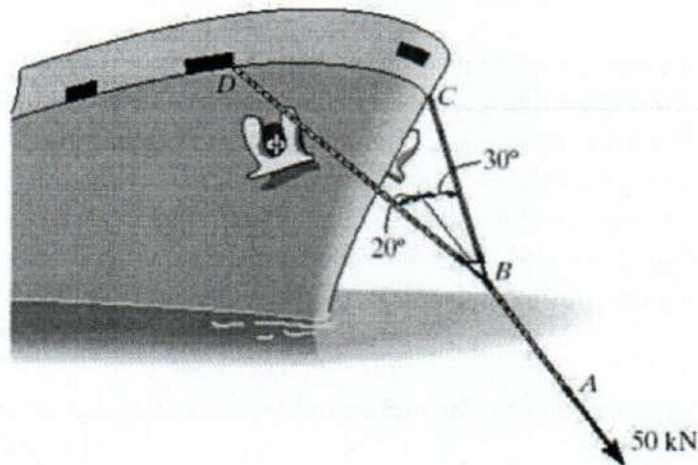
4.

a) Replace the three forces acting on the shaft beam by a single resultant force. Specify where the force acts, measured from end A



(10 marks)

- b) The towing pendant AB is subjected to the force of 50 kN exerted by a tugboat. Determine the force in each of the bridles, BC and BD, if the ship is moving forward with constant velocity.

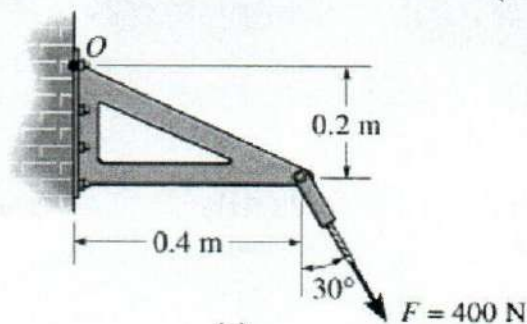


(10 marks)

5.

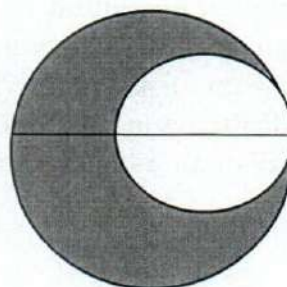
- a) The force  $F$  acts at the end of the angle bracket shown in the figure below. Determine the moment of the force about point  $O$

(5 marks)



(a)

- b) The diameter of a uniform circular plate width is 56 cm. The diameter of 42 cm circular part has removed out from the plate as shown in the figure. Find the center of gravity of new object?



(10 marks)

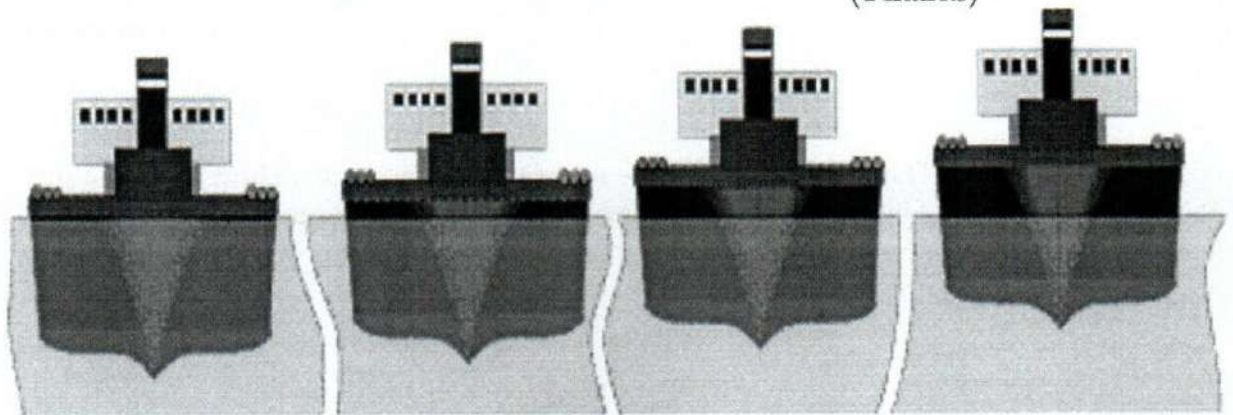


- c) Center of mass in 2D two particles of mass  $m_1 = 1\text{kg}$  and  $m_2 = 2\text{kg}$  are located at coordinates  $(1\text{m}, 2\text{m})$  and  $(-2\text{m}, 5\text{m})$  respectively in the  $xy$  plane. Find the location of their center of mass (5 marks)

6.

- a) State Archimedes' principle. (4 marks)  
 b) An iceberg of relative density 0.92 floats in sea water of relative density 1.024 with  $10615\text{ m}^3$  immersed. (Density of fresh water =  $1000\text{ kgm}^{-3}$ )  
 a. Find weight of sea water displaced?  
 b. Find the mass of ice berg?  
 c. Find the total volume of the iceberg  
 d. Hence determine the fraction of the iceberg below the water-line. (12 marks)

- c) Explain why the depth of ship immersed in the water different? (4 marks)



warm fresh  
water

cold fresh  
water

warm sea  
water

cold sea  
water

7.

- a) State Bernoulli's principle (4 marks)  
 b) What are the properties of ideal fluid (4 marks)  
 c) the airspeed on the top surface of a wing is  $105\text{m/s}$ , but only  $95\text{m/s}$  on the bottom surface. The wing has an area of  $15\text{m}^2$ . Use Bernoulli's principle to calculate the net force trying to lift the wing. Ignore other mechanical effects such as viscosity drag. Take the density of air as  $1.20\text{kg/m}^3$ .

(12 marks)



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Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET FOUNDATION COURSE

COURSE CODE : ND- 0199, B-024 / ED-0341, B-027

FINAL EXAMINATION - QUESTION PAPER  
**CHEMISTRY**

- Answer any 05 questions only
- Total Marks - 100

Date: 07.06.2024

Pass mark 50%

Time allocated: 3 Hours

Formulae and all intermediate steps taken in reaching your answer should be clearly shown

Avogadro Constant ( $N_A$ ) -  $6.022 \times 10^{23} \text{ mol}^{-1}$

H - 1.0, He - 4.0, Li - 6.9, Be - 9.0, B - 10.8, C - 12.0, N - 14.0, O - 16.0, F - 18.9, Ne - 20.2, Na - 23.0, Mg - 24.3, Al - 27.0, Si - 28.1, P - 31.0, S - 32.1, Cl - 35.5, Ar - 40.0, K - 39.1, Ca - 40.1, Ag - 108.0, Cu - 63.5, Fe - 56.0, Co - 58.9, Zn = 65.4, Sn = 117.8

1)

a) Write down the correct chemical formula

- Propane
- Potassium permanganate
- Ozone
- Calcium carbonate

(1×4= 04 marks)

b) Name the three particles of the atom; and their respective charges.

(6 marks)

c) Define the term

- Mass number
- Hydrate
- Mixture
- Valence electrons
- Covalent bonds

(2×5= 10 marks)

2)

a) How many moles are in 11.4 g of Cu?

(03 marks)

b) How many molecules are in 44 g of  $\text{AgNO}_3$ ?

(05 marks)

- c) A hydrate of magnesium sulfate has a mass of 13.52 g. This sample is heated until no water remains. The  $\text{MgSO}_4$  has a mass of 6.60 g. Find the formula of the hydrate.

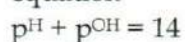
(06 marks)

- d) What is the empirical formula of the compound with the following composition, 2.1 percent H, 65.3 percent O, 32.6 percent S

(6 marks)

3)

- a) If the ion product constant of water is  $1 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$  at  $25^\circ \text{C}$ , derive the following equation



(04 marks)

- b) If  $\text{HNO}_2$  acid ionization constant ( $K_a$ ) is  $4.0 \times 10^{-4}$ , Calculate the pH value of a  $0.036 \text{ mol dm}^{-3}$  nitrous acid ( $\text{HNO}_2$ ) solution.

*Note: we assume, unless stated otherwise, that the temperature is  $25^\circ \text{C}$*

(6 marks)

- a) Calculate the pH of

i)  $0.036 \text{ mol dm}^{-3} \text{ HNO}_3$  solution

(2 marks)

ii)  $0.25 \text{ mol dm}^{-3} \text{ NaOH}$  solution at  $25^\circ \text{C}$ .

(2 marks)

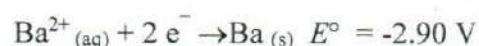
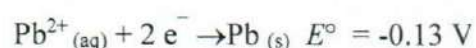
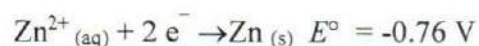
- c) Calculate the solubility of  $\text{Cu}(\text{OH})_2$  in  $1 \text{ g l}^{-1}$ ?  $K_{\text{sp}}$  of  $\text{Cu}(\text{OH})_2$   $2.2 \times 10^{-20}$

(06 marks)

4)

- a) Complete the following table with the observed reactions for the electrochemical cells. Write the correct oxidation and reduction half-reaction in the appropriate column for each.

<i>Cells</i>	<i>Anode Reaction</i>	<i>Cathode Reaction</i>	<i>Overall Cell Reaction</i>
Ba-Zn			
Cu-Pb			
Pb-Ba			



(09 marks)

b) Consider the following two reduction reactions and their standard electrode potentials:



- i. Write the balanced overall cell reaction for a voltaic cell based on these two half-reactions. (02 marks)
- ii. Calculate the standard cell potential. (03 marks)
- iii. Write the standard notation of Fe-Ni galvanic cell. (03 marks)
- iv. Draw and label the schematic diagram of Fe-Ni galvanic cell. (03 marks)

1)

- d) Explain the meaning of corrosion with examples. (04 marks)
- e) Explain the physical nature of corrosion product (04 marks)
- f) Explain how nature of cathode influencing corrosion? (04 marks)
- g) Explain how nature of medium influencing corrosion? (04 marks)
- h) Write two corrosion control method and explain it. (04 marks)

2)

- a) How does Petroleum form?
- b) Write four functions of lubricants.
- c) What are the three types of lubrications?
- d) What are the three types of lubricants?
- e) Write a short note about thick film lubrication.

(5 × 4 = 20 marks)

2)

- a) Categorized polymers according to their structural arrangement. (4 marks)
- b) Draw the polymer structure of below monomers  

$$\text{HOOC}-(\text{CH}_2)_n-\text{COOH} + \text{HO}-(\text{CH}_2)_m-\text{OH}$$
(4 marks)
- c) Explain about vulcanization of Rubber (4 marks)
- d) Mention 4 general properties of metals (4 marks)
- e) What are the Raw materials of extraction of Iron? (4 marks)



CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION &amp; TRAINING COURSE: NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE: ND-0199 - BATCH 015

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MID-TERM REPEAT EXAMINATION – QUESTION PAPER  
**INDUSTRIAL CHEMISTRY**

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- Answer ANY 5 questions only
- Formulae and all intermediate steps taken in reaching your answer should be clearly shown
- Total Marks : 100

Date: 11.05.2024

Pass mark 50%

Time allocated: 03 Hours

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Avogadro Constant ( $N_A$ ) –  $6.022 \times 10^{23} \text{ mol}^{-1}$

H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N – 14.0, O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag – 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Ag = 107.9, Sn = 117.8

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1)

a) Write down the correct chemical formula

- Ethanol
- Ammonia
- Carbon dioxide
- Benzene

(1×4= 04 marks)

b) Name the three particles of the atom; and their respective charges.

(6 marks)

c) Define the term

- Atomic number
- Viscosity
- Homogeneous mixture
- Ionic bond
- Alloy

(2×5= 10 marks)

2)

- a) How many moles of Cu are there in 103.8 g of Cu? (03 marks)
- b) Methane (CH<sub>4</sub>) is the principal component of natural gas. How many moles of CH<sub>4</sub> are present in 6.07 g of CH<sub>4</sub>? (05 marks)

- c) When 5.00 g of FeCl<sub>3</sub> · xH<sub>2</sub>O are heated, 2.00 g of H<sub>2</sub>O are driven off. Find the chemical formula and the name of the hydrate.

(06 marks)

- d) What are the empirical formulas of the compounds with the following compositions? (a) 2.1 percent H, 65.3 percent O, 32.6 percent S, (b) 20.2 percent Al, 79.8 percent Cl

(6 marks)

3)

- a) Define the p<sup>H</sup> and p<sup>OH</sup> and express their equations. (04 marks)
- b) Briefly explain the terms of Acidic solution and Basic solution at 25° C (k<sub>w</sub> = 1 × 10<sup>-14</sup> mol<sup>2</sup>dm<sup>-6</sup>). (04 marks)

- c) Indicate whether solutions with each of the following ion concentrations are neutral, acidic, or basic: (show your work out)

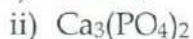
$$[H^+] = 5 \times 10^{-8} M$$

$$[OH^-] = 1 \times 10^{-7} M$$

$$[OH^-] = 4 \times 10^{-13} M$$

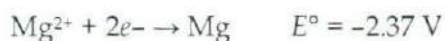
(08 marks)

- d) Write down the solubility product expression (K<sub>sp</sub>) and these solutions



(04 marks)

4)



Using above Standard Reduction Potentials,

- i) Give the anode and cathode half-reactions. (06 marks)
- ii) Write the overall equation for the chemical reaction. (04 marks)
- iii) Represent the cell using standard notation. (04 marks)

- iv) Calculate the cell potential (e.m.f.) of the electrochemical cell. (03 marks)
- b) What are the standard for temperature, Concentration and pressure? (03 marks)
- 
- 5)
- a) Explain the meaning of corrosion with examples. (04 marks)
- b) Explain the physical nature of corrosion product (04 marks)
- c) Explain how nature of cathode influencing corrosion? (04 marks)
- d) Explain how nature of medium influencing corrosion? (04 marks)
- e) Write two corrosion control method and explain it. (04 marks)
- 6)
- a) How does Petroleum form?
- b) What is the composition of crude oil?
- c) Write four function of lubricants.
- d) What are the three types of lubricants?
- e) Write a short note about fluid film lubrication.
- (5 x 4= 20 marks)
- 7)
- a) Categorized polymers according to its structural arrangement. (4 marks)
- b) Explain how polymer structure determines its characteristics. (4 marks)
- c) Teflon is a useful polymer. ( $\text{CH}_2\text{CH}_2$ )
- i. Write its monomer structure
- ii. Polymer structure
- iii. Give two Uses and applications (4 marks)
- d) Mention 4 general properties of metals (4 marks)
- e) What are the Raw materials of extraction of Iron? (4 marks)