



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:
DIPLOMA IN NAUTICAL SCIENCES

ANS 2102: APPLIED SCIENCE

END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME: 2HOURS

Instructions to Candidates

You should have the following for this examination

Answer Booklet

examination pass

mathematical table or calculator

student ID

This paper consists of **FIVE** questions.

Attempt question ONE (Compulsory), question two or three **AND** question four or five.

This paper consists of 5 printed pages

Do not write on the question paper.

Question one(30mks)

- (a) (i) Differentiate between a weak acid and a strong acid . Give one example in each case (4marks)
- (ii) Write equation for ionic product of water. (2marks)
- (b) State two conditions for formation of a co-ordinate bond. (2marks)
- (c) State (i) three factor that influence formation of ion. (3marks)
- (ii) Two conditions for hydrogen bond formation. (2marks)
- (d) Show three different ways of forming a sigma bond from s and p orbitals. (3marks)
- (e) What is meant by specific latent heat of vaporization of a substance? (1mk)
- (f) Define specific latent heat of fusion of a substance. (1mk)
- (g) A log of wood of mass 300kg floats on water, the density of wood is 750kg/m^3 . What is the maximum number of pupils of average weight 400N that can sit on this log without making it wholly submerge? (3mks)
- (h) State the laws of reflection (2mks)
- (i) What is work as defined in physics? (1mk)
- (j) Define the term transducer and state the transducer that converts sound energy to electrical energy (2mks)
- (k) A certain solid of volume 60cm^3 displaces 20cm^3 of a liquid when floating. If the density of the liquid is 600kgm^{-3} , determine the density of the solid. (3mks)
- (l) Distinguish between forward bias and reverse bias connection of a diode (2mks)
- (m) Explain how doping produces a p-type semi conductor for pure semi conductor material. (2mks)

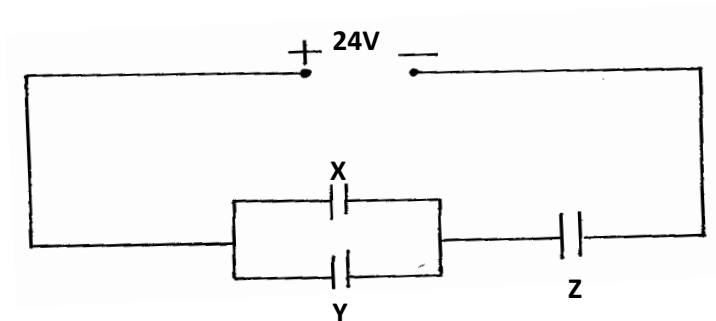
Question two(15mks)

- a) State the law of conservation of energy. (1mk)
- (b) Draw a block and tackle system with a velocity ration of 5. (2mks)
- (c) The block tackle system above was used to lift 100kg of load. Given that the efficiency of the system is 75%. Calculate the effort applied to lift the load. (2mks)
- (d) Give two reasons why the efficiency of the system is 75%. (2mks)

- (e) An effort of 60N is applied to the brake of a car jack whose hand moves through a circle of radius 17.5cm. The pitch of the screw is 2.5mm. Determine the velocity ratio of the screw Jack. (3mks)
- (f) Distinguish between forward bias and reverse bias connection of a diode (2mks)
- (g) Explain how doping produces a p-type semi conductor for pure semi conductor material. (3mks)

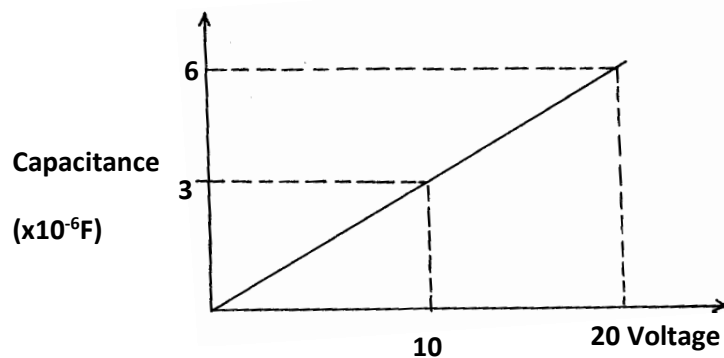
Question three(15mks)

a) The figure below shows an electrical circuit with three capacitor X, Y and Z of Capacitance $8.0 \mu\text{F}$, $10.0 \mu\text{F}$ and $6.0 \mu\text{F}$ respectively connected to a 24V battery.



Determine;

- (I) The combined capacitance of the three capacitors. (3mks)
- (II) The charge on the capacitor Z (2mks)
- (iii) The graph below shows the variation of capacitance of a capacitor with voltage supplied across it.



Use the graph to determine the quantity of charge stored in the capacitor. (3mks)

b) A block of ice of mass 40g at 0°C is placed in a calorimeter containing 400g of water at 20°C. The heat absorbed by the calorimeter is negligible. The final temperature of the mixture after all the ice has melted is T. (specific latent heat of fusion of ice=340,000 J/kg, specific heat capacity of water=4200JKg⁻¹k⁻¹)

(i) Derive an expression for the heat gained by the ice as it melts to water at temperature T.

(3mks)

(ii) Derive an expression for the heat lost by the water.

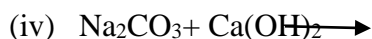
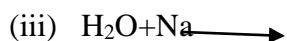
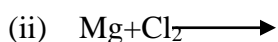
(1mk)

(iii) Determine the value of T.

(3mks)

Question four(15mks)

(a) Complete the following equations .



(4marks)

(b) Write dissociation equation of H₂SO₄ acid.

(1mark)

(c) Define physical properties and give two examples .

(2marks)

(d) Define the following terms

(i) Lattice energy.

(ii) Electron affinity. (EA)

(iii) Ionization energy. (IE)

(iv) Electronegativity.

(4marks)

(e) Write equations of 1st IE of element X and 1st EA of element Y.

(2marks)

Question five (15mks)

(a) Predict the shape of BeCl₂ molecule using hybridization.

(3marks)

(b) Elements X, and Y have atomic numbers 11, and 17

(i) write electronic configuration in form of s,p,d,f notation.

(ii) state their group and period on the periodic table. (4marks)

(c) Suggest a reason for the following.

(i) NF_3 is polar but BF_3 is non-polar (2marks)

(ii) The boiling point of H_2O , $\text{CH}_3\text{CH}_2\text{OH}$, and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$. Are in the reverse order of their molecular masses. (3marks).

(d) State three fundamental particles of an atom. (3marks)