

SECTION A

Answer ALL the questions in this section.

1. (a) Use logarithm tables to evaluate

$$\sqrt[3]{\left(\frac{8.372^{1/2} \times 0.4239^2}{6.195 \div 2.5}\right)}$$

(5 marks)

- (b) Without using mathematical tables, solve for x in the equation.

$$9^{(2x-1/4)} \times 27^{(x-1/2)} = 729^{(x+1/4)}$$

(4 marks)

- (c) Simplify

$$\log_2\left(\frac{16}{3}\right) + \log_2 48 - \log_2 40$$

(3 marks)

- (d) A slaughter house bought goats and bulls at ksh1200 and ksh15000 each. They paid a total bill of Ksh135000. If they bought double the number of goats and three bulls less, they would have saved ksh15000.

- (i) by using matrix method, determine the number of goats and bulls that were bought.
 (ii) The slaughter house sold the animals at a profit of 25% per goat and 30% per bull.
 Determine the amount of profit made.

(8 marks)

2. (a) The sum of the first eight terms of an arithmetic progression is 220. If the third term is 17, find the sum of the first six terms. (5 marks)

- (b) The sum of the first three terms of a geometric sequence is 14. If the common ratio is -3, find the sum of the first five terms. (4 marks)

- (c) The table below shows the distribution of marks of 40 candidates in a test

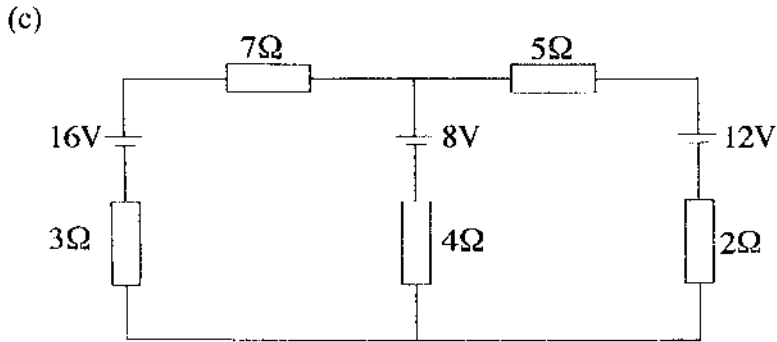
Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	2	2	3	9	12	5	2	3	1	1

Calculate the

- (i) mean
 (ii) standard deviation

(11 marks)

3. (a) (i) Define the term electromotive force and state its SI units. (2 marks)
- (ii) State the Kirchhoff's current law. (2 marks)
- (b) The resistance of 0.0025 Mega metres of wire is 190 ohms. If the cross-sectional area is 0.18mm^2 , determine the resistivity of the wire. (4 marks)



From figure 1 above, determine the:

- (i) Voltage drop across 3 ohms resistor.
- (ii) Power dissipated by 2Ω resistor
- (iii) Energy consumed by 4 ohms resistor after 15 minutes in joules. (12 marks)
4. (a) Define the following terms
- (i) Kinetic energy.
- (ii) Mechanical advantage (4 marks)
- (b) (i) With the aid of a labelled diagram, explain how a permanent magnet is made by using the electrical method.
- (ii) Outline **four** uses of permanent magnets. (7 marks)
- (c) A man uses the inclined plane to lift a 100 kg through a vertical height of 4.0M. The inclined plane makes an angle of 30° to the horizontal. If the efficiency of the inclined plane is 80%, determine the:
- (i) Amount of effort needed to move the load up the inclined plane at a constant velocity.
- (ii) the work done against friction in raising the load through the height of 4.0M. (take $g = 9.81\text{ N/kg}$). (9 marks)

SECTION B

Answer **ONE** question in this section.

5. (i) Use prime factors method to find the GCD and LCM of the following set of numbers 120,720, 1080 and 1440. (4 marks)
- (ii) Convert 372_8 to base 5. (3 marks)
- (iii) Solve the equation $3^{x+1} = 2^{2x-3}$ (2 marks)
- (iv) Convert $1.21\bar{5}$ into a fraction. (3 marks)
- (v) James takes a train for two-thirds of his journey, a bus for seven-eighth of the remainder and the rest, he walks. If his bus journey is 9km longer than he walks, how long was his complete journey. (8 marks)
6. (a) (i) State **four** types of transformers used in the industry.
- (ii) Define the term magnetic field strength. (4 marks)
- (b) An 800/200 turns transformer has primary and secondary resistances as 0.35 ohms and 0.02 ohms respectively. The primary and secondary leakage reactances are 1.5Ω and 0.05Ω respectively. Calculate the
- (i) equivalent resistance, reactance and impedance referred to the secondary.
- (ii) phase angle of the impedance. (8 marks)
- (c) A closed magnetic circuit has a mean length of 75mm and a cross-sectional area of 320.2mm^2 . If the relative permeability of the materials is 400, a flux of $200\ \mu\text{Wb}$ is produced by a coil whose current is 0.4A, determine the:
- (i) reluctance of the material
- (ii) number of turns of the coil
- (iii) flux density
- (iv) magnetising force (8 marks)
7. (a) Define the following terms
- (i) Electric field strength
- (ii) Polarization (4 marks)
- (b) (i) Outline **two** safety measures to be observed while dealing with rechargeable batteries.

(ii) With the aid of a diagram show how 3 cells can be connected in:

- series
- parallel
- series - parallel

(5 marks)

(c)

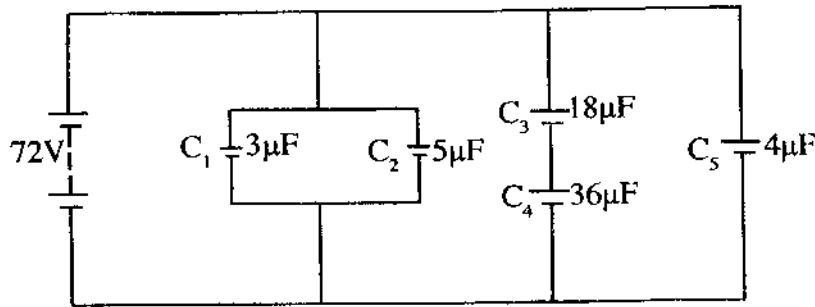


Figure 2

Figure 2 is a series parallel circuit.

Determine the:

- (i) total capacitance
- (ii) voltage drop across $18\mu\text{F}$ capacitor
- (iii) charge stored by $4\mu\text{F}$ capacitor
- (iv) energy stored by $5\mu\text{F}$ capacitor

(11 marks)

8. (a) (i) State any **two** modes of heat transfer.
- (ii) Define the term specific latent heat of vaporisation.
- (b) (i) Outline any **four** properties of electromagnetic waves.
- (ii) An X-ray machine produces radiation of wavelength 1.0×10^{-11} m. Calculate

(4 marks)

(I) the frequency of the radiation.

(II) its energy content if Planck's constant is equal to 6.63×10^{-34} Js.

(8 marks)