

6. (a) List **three** types of energy sources. **(3 marks)**
- (b) For the circuit shown below find the following: **(2 marks)**
- i. the current flowing (I) in the circuit, **(2 marks)**
 - ii. the power (P) across the resistor (R).

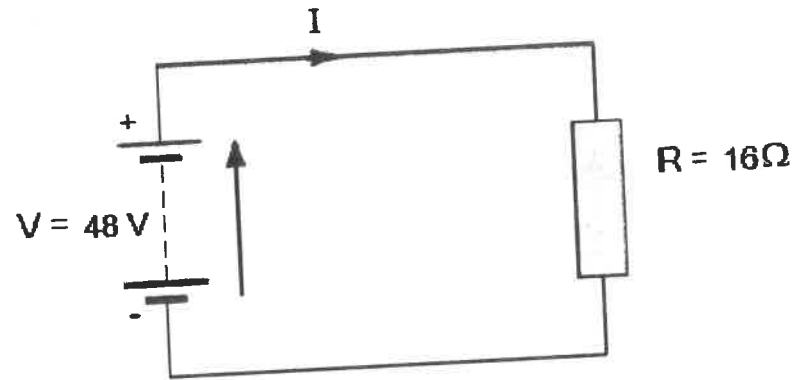


Figure 1

- (c) Calculate the current drawn by the heating element of an electric iron of resistance 36Ω and a power of 1.5 kW . **(6 marks)**
- (d) Refer to Figure 1 above for part (i):
- i. calculate the energy dissipated in the 16Ω resistor if the current (I) flowing in the circuit, flows for 25 seconds. **(3 marks)**
 - ii. calculate the cost of operating the 1.5 kW electric iron for 5 hours if the energy costs 4.55 cents per unit. **(4 marks)**

EXAMINATION FOR AUTHORISATION A

Paper 1: Theory

Date: 1 February 2022

Time: 16:00 – 19:00 (Three hours)

Total: 100 marks

END OF EXAMINATION PAPER

This examination paper contains six questions. Candidates are requested to answer any FIVE (5) questions. Candidates are also requested to include all their work in the booklet provided. Every answer should include all workings, any necessary diagrams and formulae. Use a fresh page for each different question. Each question carries 20 marks.

1. A water heater containing 100 litres of water at 12°C is electrically heated by an immersion heater of 2500 watts connected to a 230V 50Hz supply. Assuming that the system is 90% efficient, calculate
- The time taken for the temperature of the water to reach 85 °C. Take the specific heat of water as 4200 J/kg/ °C and 1 litre of water have a mass of 1kg. **(10 marks)**
 - If the immersion heater is kept on for 5 hours daily. Calculate the cost of electricity at 11 cents per kWh for a period of 13 weeks. **(10 marks)**
2. (a) Name **two** methods for charging secondary batteries and for each method briefly explain how the batteries are charged. **(4 marks)**
- (b) Two battery banks each consisting of **twelve cells** are connected in series. The data of each battery bank is as follows.
- Each cell has an emf of 2.2V and internal resistance of 0.15Ω are arranged in three parallel rows. The whole cells arrangement forms a battery bank, which is supplying a load of resistance 8Ω. Draw the battery bank arrangements. **(3 marks)**
- Calculate:
- the load current **(6 marks)**
 - the battery terminal voltage **(4 marks)**
 - the load power supplied by the battery. **(3 marks)**
3. (a) The emf induced in a conductor of effective length 0.25 metre is moving at right angles through a magnetic field at a velocity of 5 m/s is 1.375V. Calculate the magnetic flux density. **(10 marks)**
- (b) The flux linking a coil of 50 turns changes from 0.042 Wb to 0.075 Wb in 0.003 seconds. Calculate the emf induced. **(10 marks)**

4. Two tariffs are available to a domestic consumer as follows:
- Tariff A = A standing charge of 5.11 Euros per quarter plus 4.79 cents for each unit used.
- Tariff B = A standing charge of 7.53 Euros per quarter plus 2.21 cents for each unit used between midnight and 8.00 am and 5.18 cents for each unit used at any other time.
- In a particular quarter, the consumer uses 4140 units, of which 1500 are used between midnight and 8.00 am.
- Calculate the cost of the electrical energy supplied if the consumer chooses Tariff A. **(8 marks)**
 - Calculate the cost of the electrical energy supplied if the consumer chooses Tariff B. **(8 marks)**
 - Which is the cheaper of the two tariffs and how much does the consumer save? **(4 marks)**
5. A 10Ω resistor, a 100 μF capacitor and an inductor of inductance 0.15 H are connected in series to a supply 240V, 50 Hz supply.
- Draw a well labelled diagram for the configuration. **(2 marks)**
- Calculate the following:
- the impedance of the circuit **(4 marks)**
 - the current flowing in the circuit **(2 marks)**
 - the p.d. across each component **(3 marks)**
 - the overall power factor **(3 marks)**
 - the power. **(3 marks)**
 - Draw the phaser diagram. **(3 marks)**