ITEM 7:

a) - The device is essentially a transformer. A transformer operates on the principle of electromagnetic induction.

- It consists of two coils of wire; the primary and secondary coils wound around a soft iron core.

- The primary is connected to the generator producing 240V and the secondary coil will output 120V.

- When an alternating current (a.c) flows through the primary coil, it creates a changing magnetic field in the iron core which induces a voltage in the secondary coil..

b)   Voltage ratio = Turns ratio.

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$\frac{240}{120} = \frac{3000}{N_s}$$

$$N_s = \frac{3000 \times 120}{240}$$

$$N_s = 1500 \text{ turns.}$$

The welder should wound 1500 turns on the output part of the device.

c)
- Copper wires have an excellent electrical conductivity which minimises energy loss as heat due to resistance
- Copper is ductile and malleable making it easy to wind into coils without breaking.

d)
- Use of high quality, laminated soft min core material to reduce energy loses due to hysteresis and eddy currents
- Proper insulation.
- Conducting regular maintenance.
- Minimise wire resistance
- Use oil in the device to reduce the humming noise resulting in low vibrations.

ITEM 6.

a) Flat iron $\qquad$ 1500W × 5hrs

cooker.
$\qquad$ 2500W × 4×7

$= 7500$ whr

$= 7.5$ kWh.

$= 70,000$ Wh

$= 70$ kWh

Electric lamps

$(20 \times 13 \times 7) \times 4$

$= 7280$ whr

$= 7.28$ kWh

fence

$2200W \times 10 \times 7$

$= 154000$ Wh

$= 154$ kWh

Total KWh $= 7.5 + 70 + 7.28 + 154$

$= 238.78$ kWh

Total cost $= 238.78 \times 797$

$= 190,307.66$ f=

No, sh. 50,000 wouldn't be enough, since the bill for a week is more than sh50,000.

b) Sockets should be connected in parallel to ensure maximum current flow. This allows each appliance to receive the full voltage resulting in high current flow.

c)
- Low resistance wires are used to minimise energy lost as heat.
- Lower resistance allows for more efficient current flow, reducing energy dissipation.

d)
- Use energy efficient appliances with lower power ratings.
- Reduce the duration of use for appliances.
- Use natural light during the day instead of electric lamps.
- Install solar pannels to generate electricity.

ITEM 5.

a) Let the final temperature be T.

Heat lost by = Heat gained by water at 15℃
water at 70℃   plus heat gained by the basin

$$2 \times 4200 \times (70-T) = 3 \times 4200 (T-15) + 3 \times 400 (T-15)$$

$$8400 (70-T) = 12600 (T-15) + 1200 (T-15)$$

$$588000 - 8400T = 12600T - 189,000 + 1200T - 18000$$

$$588000 + 189000 + 18000 = 12600T + 1200T + 8400T$$

$$795000 = 22200T$$

$$T = 35.8°C .$$

Yes the water cooled to the required temperature
as directed by the doctor since it is in
the range 35°C to 40°C.

b) $4200 J kg^{-1} k^{-1}$ means that heat of $4200J$ is
required by 1kg of water to raise it's temperature
by 1K.
  or.
                                    the temperature of
It takes $4200J$ to raise 1kg of water by 1K.
                          ∧

c) — Cold water has a high specific heat capacity, allowing it to absorb a large amount of heat without a significant rise in temperature.

- Water is readily available.

- Other liquids may cause damage to the engine components.

- Other liquids may not effectively transfer heat.

d) — The radiator is painted black because black surfaces are better at absorbing and radiating heat.

- The small metal wires increase the surface area of the radiator allowing for more efficient heat transfer.