**4.20** **ELECTRICITY (448)**

**4.20.1  Electricity Paper 1 (448/1)**

**SECTION A**

1. (a) **Procedure of connecting an ammeter to take measurements in a circuit**

- Turn - off the power

- Ammeter should be connected in series with the load current.

- Observe polarity.

- Select the range starting from the highest.

(b) (i) **Nominal resistance**

(4 #

1

2

= 2 marks)

Orange Black Brown

3 0 x 101 =  300 Ω

`  Nominal = 300 Ω (1 mark)

(ii) **Maximum resistance**

300 +  5% =  315 Ω (2 marks)

2. (a) **Circuit diagram**

- Shows connection of every component.

- Shows values of components.

- Shows the position of the components.

- Shows functionality of the circuit.

(b) **Bills of materials**

(any 2 # 1 = 2 marks)

- Materials/parts.

- Quantity.

- Size.

- Estimate costs.

(4 #

3. (a) (i) **Forward bias**

reduces ^~~21~~ h the PN-junction (depletion layer) and hence the diode

conducts ^~~21~~ h.

1

2

= 2 marks)

(ii) **Reverse bias**

increases ^~~21~~ h the PN-junction (depletion layer) hence the diode does

not conduct ^~~21~~ h.

534

(2 marks)

(b) (i) IF(max):  is the maximum forward current that the diode can pass without

burning out. (1 mark)

(ii) VF(typ):  is the forward voltage across the diode at the typical operating

current. (1 mark)

R

4. (a) Ip =  V

=  100 Vrms

1  kX

= 0.1 A

^~~21~~ h

^~~21~~ h

^~~21~~ h

(b) N1I1 = N2I2 (1)

` 1200 # 0.1 = 400 # I2

I2 = = 0.3 A

120

400

V2 = I2 R2

= 0.3 x 8000

^~~21~~ h

^~~21~~ h

^~~21~~ h

^~~21~~ h

= 2,400

^~~21~~ h

(5 marks)

5. (a) (b)

Drawing = ^~~21~~ h Drawing = ^~~21~~ h

Labelling = ^~~21~~ h Labelling = ^~~21~~ h

Direction = ^~~21~~ h Direction = ^~~21~~ h

= 1^~~21~~ h marks = 1^~~21~~ h marks

6. (a) (i) E = 5 + ^I # R1h

= 5 + ^2 # 10-3 # 2000h

= 5 + 4

=9V

535

^~~21~~ h

^~~21~~ h

^~~21~~ h

I

(ii) R2 =  V2

^~~21~~ h

=    4V

2mA

^~~21~~ h

= 2 kX

^~~21~~ h

V3

R3 = = 1V   = 0.5 k

(iii)

I 2mA

(b) (i) **Energy consumed**

Lights  5 # 60 # 4 = 1.2 kwh

Kettle  1 # 2 # 0.5 = 1.0 kwh

(1)

^~~21~~ h

^~~21~~ h

(4 marks)

Total energy = 2.2 kwh (1)

(ii) **Cost of energy**

= 2.2 # 80 = 1.76 sh (1)

7. (a) **Safety precautions to be observed**

(3 marks)

- Ensure that the equipment is properly earthed.

- Do not use it in damp areas.

- Always remove the plug from the socket when the equipment is not in use.

- When using extensions, ensure the joints are firm and insulated using the

electricians insulation tape.

- Hold it firmly.

- Avoid loose clothing like ties.

(any 3 # 1 = 3 marks)

(b) **Communication service providers in Kenya**

- Telkom Kenya

- Safaricom

- Airtel

- Yu

8. (a) **Insulating materials used in electrical circuits**

(4 #~~21~~ = 2 marks)

*or any other existing ones*

- PVC

- Porcelain

- Magnesium oxide

- Paper

- Rubber

- Air

- Formica

(4 #

1

2

= 2 marks)

536

(b) **Advantages of PVC**

- Easy of erection.

- It is cheap.

- It is resistant to corrosion.

- It is light.

- There is no risk to earth leaks.

9. (a) **Inductance required**

(any 3 # 1 = 3 marks)

L =

4r2 f C

1

2

^~~21~~ h

= 1.13 # 10-3 H

= 1.13 H

(b) (i) **Apparent power**

= IV

= 2.5 # 240

= 600 VA

(ii) **True power**

^~~21~~ h

^~~21~~ h

^~~21~~ h

^~~21~~ h

1

(2 marks)

= apparent power # power factor

= 600 # 0.6

^~~21~~ h

^~~21~~ h

10.

= 360 w

^~~21~~ h

(3 marks)

Faces = 4 #

Neatness =

Proportionality =

Holes = 2 #

Projection = 1

1

2

1

2

1

2

1

2

= 2

= 1

(5 marks)

537

**SECTION B**

11.

538

12. (a) **Name of waveforms**

A - sine wave

B - saw tooth

^~~21~~ h

^~~21~~ h

(b) **Number of cycles**

A - 2 cycles (1)

B - 3~~41~~  cycles (1)

(c) (i) **Frequency of waveform A**

T

=  1  where T = period

T = 50n # 4

^~~21~~ h

(1)

= 200 μs (1)

^~~21~~ h

= 5 kHz (1)

(ii) **Amplitude**

A = Vpk = 200 mV # 3 (1)

= 600 mV (1)

= 0.6 V

B = Vpk = 0.5 V # 2 (1)

= 1 Vpk (1)

(iii) **RMS value of A**

= 0.707 # Vpk (1)

= 0.707 # 0.6

= 0.424 V (1)

539

(13 marks)

13. (a)

Correct Drawing = 8

Labelling 6 items = 3

(b) (i) Lighting circuit = 5A

(ii) Ring circuit = 30 A

(iii) Water heater = 20 A

(iv) Door bells = 5 A

(v) Cooker unit = 45 A

540

(11 marks)

(any 4 #~~21~~ = 2 marks)

**(Total = 11 + 2 = 13 marks)**

14. (a) (i) **Type of transistor**

NPN (1)

(ii) **Function of capacitor C**

To block D.C (1)

(iii) **Type of biasing**

Fixed bias (1)

(b) (i) VR1 = VCC - Vbe (1)

= 6.0 - 0.6

= 5.4 V (1)

(3 marks)

(ii) IB =  VR1 =

1

5.4

100 # 103

(1)

= 5.4 # 105

= 54 μA

(iii) IC = βIB (1)

= 54 # 10-6 # 50 (1)

= 2.7 mA

(iv) Voltage VCE

VR2 = IC # R2 (1)

= 2.7 mA # 1 # 103

= 2.7 V (1)

VCE = VCC - VR2 (1)

= 6 - 2.7 V

= 3.3 V (1)

541



15. (a) (i) *XL* = 2r*fL*

= 2r # 50 # 0.05

= 15.70 Ω

(1)

^~~21~~ h

^~~21~~ h

*XC* =

1

2r*fc*

(1)

=

1

2r # 50 # 2 # 10-6

^~~21~~ h

= 1592 Ω

^~~21~~ h

*Z* =

=

*R*2 + ^*XC* -*XL*h2

10002 + ^1592 - 15.7h2

(1)

(1)

= 1866 Ω (1)

(ii) Current =  V (1)

Z

(7 marks)

=   240

1866

(1)

(b)

= 0.12 A

^~~21~~ h      Amps  ^~~21~~ h      (1)

XL

(3 marks)

XC - XL

XC

ø

R

Z

V2

I

Axes = 1

Labelling = 4 #

1

2

= 2

(3 marks)

542