ELECTRICITY (448)

30.18.2   Electricity Paper 1 (448/1)

1.   (a)   CONDITIONS FOR COMBUSTION
       Fuel
       Oxygen
       Heat   (3 x ½)

     (b)   TYPES OF EXTINGUISHERS
       Carbon dioxide
       Dry powder
       Water
       Foam   Any (3 x ½)

2.   (a)   TYPES OF INSTITUTIONS
       Technical Training Institute
       National Polytechnics
       Institutes of technology
       Youth polytechnics   Any (4 x ½)

     (b)   DRY JOINT
       Occurs if solder was not enough when joint was made.   (2 marks)

3.   (a)   CAPACITORS
       Air capacitor
       Paper
       Mica
       Electrolytic
       Tantalum   Any (4 x ½)

     (b)   (i) $V_1 = 200 \times \dfrac{4}{4+6} = 80V$

                $V_2 = 200 - 80 = 120V$

       Charge is the same on each capacitor.
       $Q = CV = 6 \times 10^6 \times 80 = 0.00048C$ (4 x 1)

4.   SECONDARY CELLS
     Lead acid and alkaline.   (2 x ½)

     (b)   Total EMF = 1.5V
         Total Internal resistance $= \dfrac{v}{R} = \dfrac{1.2}{6} = 0.2\Omega$

   Total circuit resistance $= R + r = 10 + 0.2 = 10.2\Omega$ (3 x 1)

5.   (a)   RESISTANCE
       (i) $54 \times 10^1 \Omega \pm 5\% = 540\Omega \pm 5\%$

       (ii) $63 \times 10^2 \Omega \pm 20\% = 6.3K\Omega \pm 20\%$ (2 x 2)

       $\dfrac{\Delta i}{\Delta t} = \dfrac{3-6}{0.04} = 75 \; amps \; per \; sec.$

     (b)   Average emf $= -t\dfrac{di}{dt} = 0.5 \times -75 = 37.5V$ (2 x 1)

547

6.   (a)   MAGNETIC INFLUX
                form closed loop.
                do not intersect.
                they are elastic.
                lines of same polarity repel or vice versa.

                                                  Any (3 x 1)

     (b)   Deflecting device - moves pointer over the instruments scale to enable quantities
                to be measured.

                Controlling device - allows the pointer to stop so that the scale can be read. Also
                allows pointer to return to zero.

                Damping device - prevents the pointer form oscillating to enhance steady value reading.
   Any (3 x 1).

7.   (b)   LIGHT GAUGE PVC CONDUIT
                -    Saves time during installation.
                -    no burrs left in conduit after cutting.
                -    simplifies routing conduit round corners.
                -    Nail holes close up to avoid entry of moisture.
                -    Less costly.   Any (2 x 1)

8.   (a)   Forward voltage is roughly double that of germanium diodes.
                Can withstand higher reverse voltage.
                Can operate at temperatures upto 150^0 -200^0 compared to 75^0 - 90^0c.
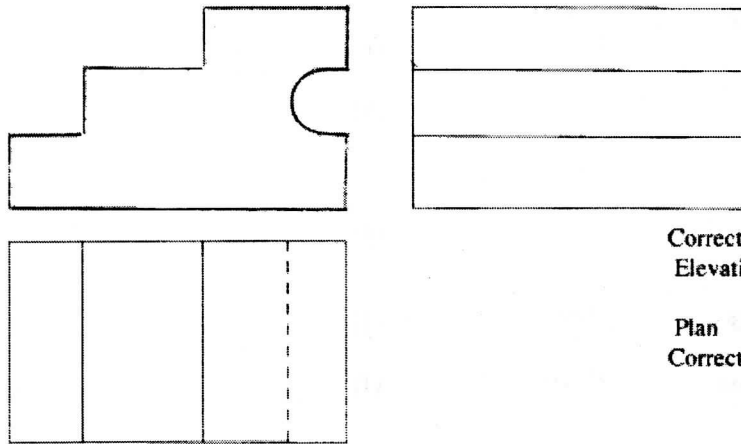   Any (2 x 1)

     (b)

(2 marks)

9.   (a)
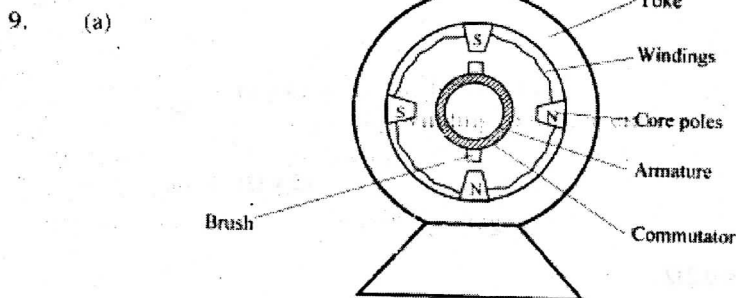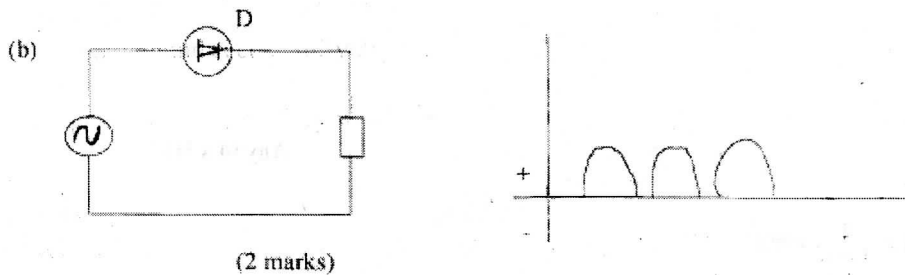
Sketching 5 parts x ½ = 2½

Labeling any 5 parts x ½ = 2½

     (b)   (i)   overload or low supply
                (ii)   faulty thermostart
                (iii)   faulty or loose starter or
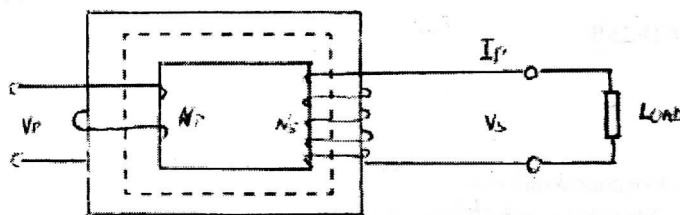   (iv)   low voltage or aged lamp   (3 x 1)

548

10.

11. (a)

Vs & Vp = primary and secondary voltages.

Np & Ns = primary and secondary windings.

Sketch:
Primary side   (1)
Secondary side (1)
Core   (1)
Flow of magnet influx (1)

The supply voltage will circulate on alternating magnetic flux in the core.
This flux will link with secondary winding to induce emf.
The induced emf will depend on the number of turns in the secondary windings as well as rate of change of magnetic flux.
The windings turns (N) and terminal voltage can be expressed as   (4 x 1)

$$\frac{Vp}{Vs} = \frac{Np}{Ns}$$

11. (b) (i) $200000 = VpIp = VsIs$

$$Ip = \frac{200000}{11000} = 18.18A$$ (2½ marks)

(ii) $\frac{Vp}{Vs} = \frac{Np}{Ns}$. $Ns = \frac{Np \times Vp}{Vp} = \frac{600 \times 240}{11000} = 13 \, turns$ (1½ marks)

12. (a)   Let resistors be R_1 and R_2

Total resistance $\frac{1}{R_r} = \frac{1}{R_1} + \frac{2}{R_2} \implies \frac{1}{R_r} = \frac{R_1 + R_2}{R_1 R_2}$ then $R_r = \frac{R_1 + R_2}{R_1 R_2}$ (2 marks)

(b)   Frequency - the number of cycles per second.
Amplitude - the peak or maximum value measured.
Periodic time - time taken to complete a cycle.   (3 x 1)   (3 marks)

549

(c)   (i) $X_l = 2\pi fl = 2 \times 3.14 \times 50 \times 0.03 = 9.42\Omega$ (1)

         Impendance $Z = \sqrt{5^2 + (9.42)^2} = 10.66\Omega$ (1)

         Current $I = \dfrac{V}{Z} = \dfrac{240}{10.66} = 22.5A$ (1)

(ii) $\tan X = \dfrac{Xl}{R} = \dfrac{9.42}{5} = 1.884 = 62.04^\circ$ (1)

(iii) Power factor $= Cos\phi = Cos\, 62.04 = 0.4688$ (1)

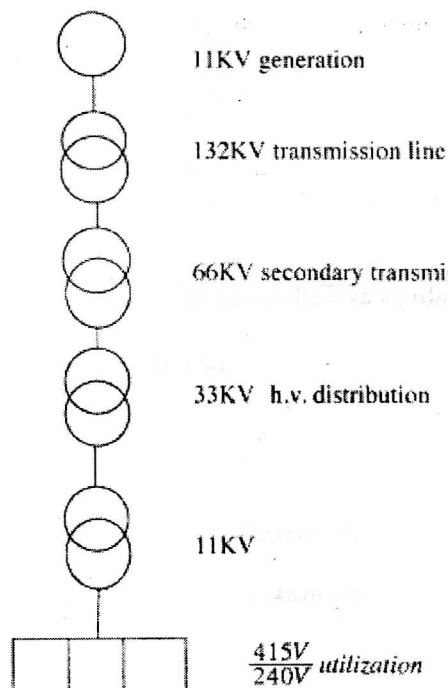(iv) Apparent power $= VI = 240 \times 22.5 = 5400W$ (1)

(v) Active power $= VI\cos\phi = 5400 \times 0.4688 = 2531.52W$ (1)
         or alternatively
         $or\ P = I^2 R = 22.5 \times 5^2 = 2531.25W$
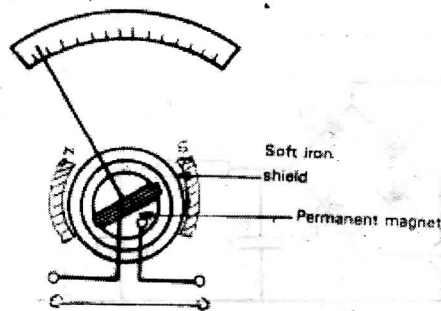
(b)   **POLARITY TEST**
Done to establish that
  (i)   All fuses and switches are connected to live conductors only.
  (ii)   Socket outlets have the live conductor connected to the terminals marked L,
          Neutral to N and earth to E.
  (iii)   The centre contact of bayonet and Edison screw lamp holder have their outer
          contacts connected to earth conductors.   (3 x 1)

(c)

11KV generation

132KV transmission line

66KV secondary transmission

33KV h.v. distribution

11KV

$\dfrac{415V}{240V}$ *utilization*

                                        6 x 1

550

14.

Soft iron
shield

Permanent magnet

(6 x ½)

The moving coil instrument consist of a coil made of copper wire wound in rectangular frame and situated in a magnetic field. (2 x 1)

The pointer is mounted on bobbin (1)

The frame is attached to highly polished pivot which rests on jewels and rotates with minimum friction. (1)

The controlling device has two hair springs wound in the opposite direction. (1)

OPERATION

When the current flows in the coil, it becomes an electromagnetic producing its own magnetic field.
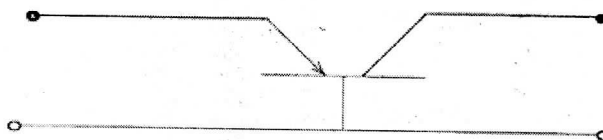
The coil field interacts with the permanent magnetic field to producing a turning force.

The magnitude of the turning force is determined by the current through the coil.

Damping is achieved by eddy current and involve an aluminium device for damping.

(4 x 1)

15. (a) PNP TRANSISTOR AMPLIFIER

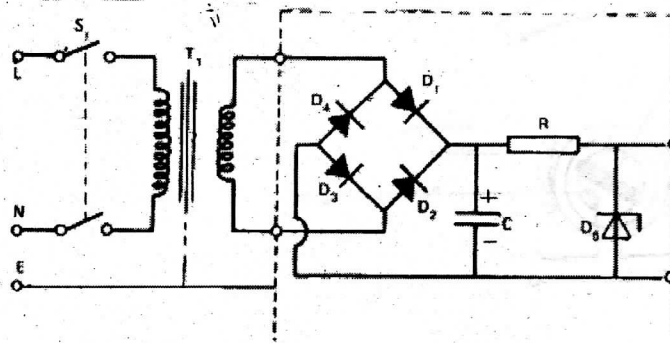
Correct identification of PNP (1)
Common base configuration (1)
Labelling input and output (1)

551

(b)

Correct circuit connection:
- Switch to transformer primary
- Transformer secondary to bridge
- Bridge to capacitor
- Capacitor to resistor
- Resistor to Zener

(5 x 1)

Correct polarity   (1)

Correct bridge   (3)

Total   9 marks