CATHODE RAYS

1. Thermionic emission.[1m]
Thermionic emission is the phenomenon by which free electrons from surface of a metal are emitted when heated to a high temperature. [1m]

2. (i) Cathode rays are a beam of electrons emitted from a hot cathode.[1m]

   (ii) Properties:

   a)   They are deflected by magnetic field.[1m]

   b)   They are deflected by electric field.[1m]

   c)   They produce fluorescence on certain materials such as Zinc Sulphide.[1m]

[Total 4m]

3. (a) (P =) VI or 6.0 × 1.6 C1
9.6 W A1 [2]
(b) (i) filament/J releases electrons
or thermionic emission B1
attracted by +ve terminal/metal plate/K B1
electrons move/accelerate B1
(ii) otherwise electrons hit (air) molecules/particles/lose energy
or electrons deflected/don't hit screen/cause ionisation of air B1
(iii) electrons/charges/beam/ray deflected (by magnetic field) B1
few(er) electrons reach plate/K/+ve terminal/pass round circuit B1
(iv) current = 0 or no reading B1
electrons repelled by or not attracted to K
or K does not emit electrons B1 [8]
(c) (i) (dot/speck of light) moves so fast (that the eye sees it as a single line) or
timebase pulls it horizontally or voltage is constant/zero B1
(ii) (line/trace) displaced vertically M1
at uniform rate/speed or slowly A1
moves 3.0 divisions/3cm B1
(iii) screen not high enough or trace moves beyond edge of screen
or line moves 6cm / more than 4cm (vertically) or line can only move 4cm or
screen is only 4cm from middle to top B1 [5]
[Total: 15]

4. (a) (i) filament is hot / heated (by current from 6V supply) / thermionic emission
B1
(ii) anode is positive / anode attracts electrons / electrons attracted to +
(electric) field from anode to cathode

B1

(iii) otherwise electrons stopped / deflected / slowed down /
collide (with air atoms)
(accept no opposition to movement, to reach screen, to avoid air resistance)
B1

(b) up and down vertical or side to side movement (not on both axes)
electrons deflected by electric field or attracted to + or repelled by –
or plates are charged (e.g. plates are +ve and –ve)
B1
B1

Total [5]