**Name of the Student**:_____
**Max. Marks : 21 Marks** **Time : 21 Minutes**

Mark Schemes

## Q1.

(a) 1: vacuum / evacuated (tube) **(1)**
2: lead (lined shield) **(1)**
3: electrons (beam) **(1)**

**3**

(b) (i) heat is spread over a greater volume / area / section **(1)**
thus allows more energetic X-rays to be produced
[or allows X-rays to be generated for longer] **(1)**

(ii) (bevelled edge) gives larger target area **(1)**
but small source area (to produce sharp image) **(1)**

**max 3**

(c) (i) the fraction of X-rays removed per unit thickness of the material **(1)**

(ii) the thickness of the material which will reduce the intensity to half its original level **(1)**
for a specified energy of the X-rays (in either (i) or (ii)) **(1)**

**2**

(d) (use of $\mu = \frac{\ln 2}{t_{1/2}}$ gives) $\mu = \frac{\ln 2}{3.2}$ = 0.22mm$^{-1}$ **(1)**(0.217 mm$^{-1}$)

(use of $I = I_o e^{-\mu x}$ gives) $I$ = 6.0 × e$^{-0.217 \times 2}$ **(1)**
(allow C.E. for value of $\mu$)
= 3.9 W m$^{-2}$ **(1)**

**3**

**[11]**

## Q2.

(a) ear has logarithmic response **(1)**
accommodates wide range of intensities **(1)**

**2**

(b) dB scale has a flat response with frequency **(1)**
dBA scale is frequency compensated **(1)**
for dBA, threshold intensities are different for different frequencies **(1)**

**3**

(c) (use of intensity level =10 log $\left(\frac{I}{I_0}\right)$ gives ) 94 = 10 log $\left(\frac{I}{1.0 \times 10^{-12}}\right)$ **(1)**

$I$ = 1.0 × 10$^{-12}$ × 10$^{9.4}$ **(1)** = 2.5 × 10$^{-3}$ W m$^{-2}$ **(1)**

(d) intensity = $2 \times 2.5 \times 10^{-3}$ (W m$^{-2}$) **(1)**
(allow C.E. for $I$ from part (c))

intensity level = $10 \times \log \left( \frac{5.0 \times 10^{-3}}{1.0 \times 10^{-12}} \right)$ = 97 dB **(1)**

**2**

**[10]**