PHYSICS – PILOT STUDY

Written examination 2

DATA SHEET

Directions to students

Detach this data sheet before commencing the examination.

This data sheet is provided for your reference.

1	photoelectric effect	$E_{k\,\text{max}} = hf - W$
2	photon energy	$E = hf$
3	photon momentum	$p = \dfrac{h}{\lambda}$
4	de Broglie wavelength	$\lambda = \dfrac{h}{p}$
5	resistors in series	$R_{\text{T}} = R_1 + R_2$
6	resistors in parallel	$\dfrac{1}{R_T} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$
7	magnetic force	$F = I\,l\,B$
8	electromagnetic induction	emf : $\varepsilon = -N\dfrac{\Delta\Phi}{\Delta t}$ flux: $\Phi = BA$
9	transformer action	$\dfrac{V_1}{V_2} = \dfrac{N_1}{N_2}$
10	AC voltage and current	$V_{\text{RMS}} = \dfrac{1}{\sqrt{2}}V_{\text{peak}}$ $I_{\text{RMS}} = \dfrac{1}{\sqrt{2}}I_{\text{peak}}$
11	voltage; power	$V = RI$ $P = VI$
12	transmission losses	$V_{\text{drop}} = I_{\text{line}}\,R_{\text{line}}$ $P_{\text{loss}} = I_{\text{line}}^2\,R_{\text{line}}$
13	mass of the electron	$m_{\text{e}} = 9.1 \times 10^{-31}$ kg
14	charge on the electron	$e = 1.6 \times 10^{-19}$ C
15	Planck's constant	$h = 6.63 \times 10^{-34}$ J s $h = 4.14 \times 10^{-15}$ eV s
16	speed of light	$c = 3.0 \times 10^8$ m s^{-1}

Detailed study 3.1 – Synchrotron and applications

17	energy transformations for electrons in an electron gun (<100 keV)	$\dfrac{1}{2}m\,v^2 = e\,V$
18	radius of electron beam	r = p/qB
19	force applied to an electron beam	F = qvB
20	Bragg's Law	$n\lambda = 2d\sin\theta$
21	electric field between charged plates	$E = \dfrac{V}{d}$

Detailed study 3.2 – Photonics

22	band gap energy	$E = \dfrac{hc}{\lambda}$
23	Snell's Law	$n_1 \sin i = n_2 \sin r$
24	acceptance angle	$\theta_A = \sin^{-1} \sqrt{\left(n_1{}^2 - n_2{}^2\right)}$
25	numerical aperture	$NA = \sin \theta_A$

Detailed study 3.3: –Recording and reproducing sound

26	speed, frequency and wavelength	$v = f\lambda$
27	intensity and levels	sound intensity level (in dB) $= 10 \log_{10}\left(\dfrac{I}{I_0}\right)$ where $I_0 = 1.0 \times 10^{-12}$ W m^{-2}

Prefixes/Units

$p = pico = 10^{-12}$

$n = nano = 10^{-9}$

$\mu = micro = 10^{-6}$

$m = milli = 10^{-3}$

$k = kilo = 10^{3}$

$M = mega = 10^{6}$

$G = giga = 10^{9}$

$t = tonne = 10^{3}$ kg

END OF DATA SHEET