

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

Detailed study 3.1 – Synchrotron and applications

17	energy transformations for electrons in an electron gun (<100 keV)	$\frac{1}{2} m v^2 = e V$
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	$E = \frac{V}{d}$

Detailed study 3.2 – Photonics

22	band gap energy	$E = \frac{hc}{\lambda}$
23	Snell's Law	$n_1 \sin i = n_2 \sin r$
24	acceptance angle	$\theta_A = \sin^{-1} \sqrt{n_1^2 - n_2^2}$
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 $(\text{in dB}) = 10 \log_{10} \left(\frac{I}{I_0} \right)$ where $I_0 = 1.0 \times 10^{-12} \text{ W m}^{-2}$

Prefixes/Units

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

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

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

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

$$k = \text{kilo} = 10^3$$

$$M = \text{mega} = 10^6$$

$$G = \text{giga} = 10^9$$

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

END OF DATA SHEET