ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

MARKING SCHEME

NOVEMBER 2012

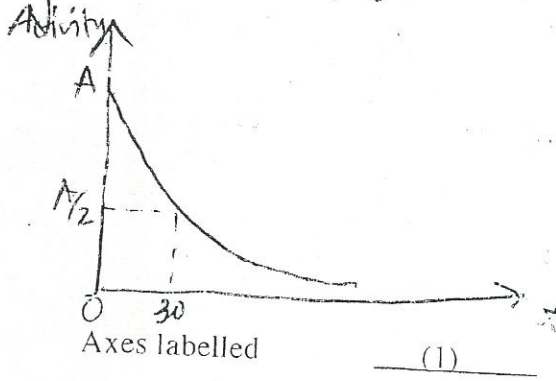
PHYSICS

9188/5

1 (a) (i) The probability of decay per unit time OR B1

$\lambda = \frac{dN}{dt}\frac{1}{N}$, explain N / $\lambda = \frac{0.693}{t_{\frac{1}{2}}}$, $t_{\frac{1}{2}}$ explained

(ii) constant of proportionality in the decay law / activity ∝ no of nuclei



Axes labelled (1)

Correct shape (1) If it touches time axis then O.

$T_{\frac{1}{2}}$ shown (1)

B3

(iii) After 40 days activity of Y ≈ 0 / can show by calculation $A_{40} \approx 0$ B1

$\therefore \; 2\times10^{3} = Ax_0 2^{\left(\frac{-40}{25}\right)}$ / $2\times10^{3} = A_{x_0} e^{-0.693\times\frac{40}{25}}$

OR $Ax_0 = 6.06\times10^{3}\,Bq$ C1

$Ay_0 = 16 - 6.06 = 9.94$ C1

$\%\; Ay_0 = \frac{9.94}{16.0}\times100\;\% = 62.1\%$ A1

(b) (i) $hf = hf_0 + \frac{1}{2}mv^2_{max}$ / Accept A/λ B1

terms explained B1

(ii) 1. ammeter reading increases / current increases / No of photoelectrons increases B1

2. - inert electrode is made more negative B1
- until the ammeter (just) reads zero / no more electrons B1
- at this point even the most energetic electron will be prevented from reaching the electrode / $E_k = eV_s$ B1

3 - Planks constant = gradient B1
= calculation
= (6.5 ± 0.2) x 10^{-34} Js C1,A1

Threshold frequency = X – intercept
(by calculation) = $(2.1 \pm 0.3)\ 10^{14}\ Hz$ accept i.e. of shown on graph C1.A1

Work function = (–) Y – intercept / hf_o
(by calculation) = (–) $(1.37 \pm 0.2)\ 10^{-19}$ J | 0.86eV C1, A1 accept e.c.f. for threshold

C1.A1

(e) (i) Inverting with – ve feedback B1

(ii) gain = $\frac{-Rf}{Ri}$ = $-\frac{+99 \times 10^6}{9 \times 13^3}$ C1

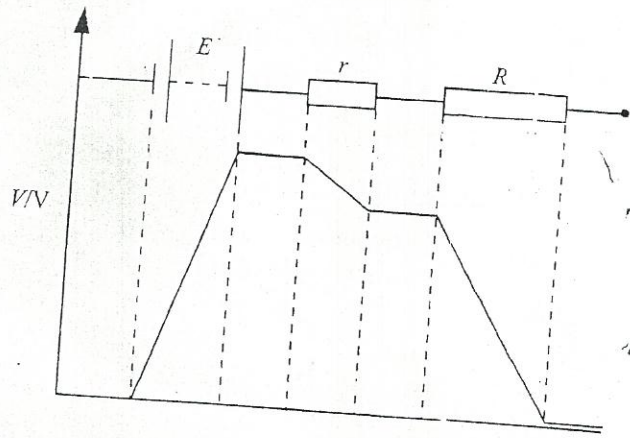
= -1.1×10^4 A1

No A mark if units given.

2 (a) resistance R = V/I terms explained B1

the Ohm = resistance of a conductor when a p.d. of one volt is across it and a current of one ampere through it B1

(b) (i)



Constant for wire/lead — B1

Drop for resistors — B1

Large drop for R — B1

Fig.2.2

(ii) Total resistance = ~~10~~ R +0.1 ~~= 10.1 Ω~~ R + 0.1 C1

opt potential divider rule

$I = \frac{12}{R+0.1}$ ~~$= \frac{12}{10.1}$~~

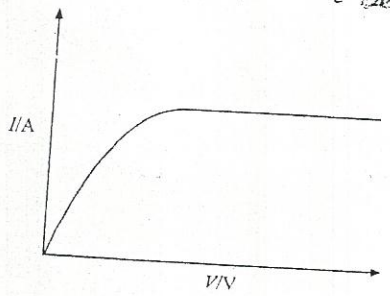
Energy lost per unit charge = ~~1.19 × 0.1~~ $\frac{12 \times 0.1}{R+0.1} = \frac{1.2}{R+0.1}$ C1

= 0.119V

(c) advantage: - prevent large current from damaging battery / increases the optimum power. B1

disadvantage - increases energy loss in battery / 4 W. B1

(d)



comparison to show higher to be clear. small current will be supplied by battery.

Fig.2.3

* Axes labelled - ~~inclusive of unit~~ ignore units (presence or absence), B1

correct shape B1

(ii) resistance increases with temperature B1

3 (a) (i) ~~no effect~~ Current does not vary with frequency B1

(ii) decreases in current B1

$N_s \propto I_p$ B1

(b) (i) $Vs = \frac{Ns}{Np} \times Vp$ C1

$= \frac{60}{1\ 200} \times 240 = 12V$ C1

Current = V/R = 12/40

= 0.3A A1

(ii) no energy loss / accept A/W eg 100% efficiency B1
Reject $\frac{Ns}{Np} = \frac{Vs}{Vp}$ without justification. transformer is ideal

(c)

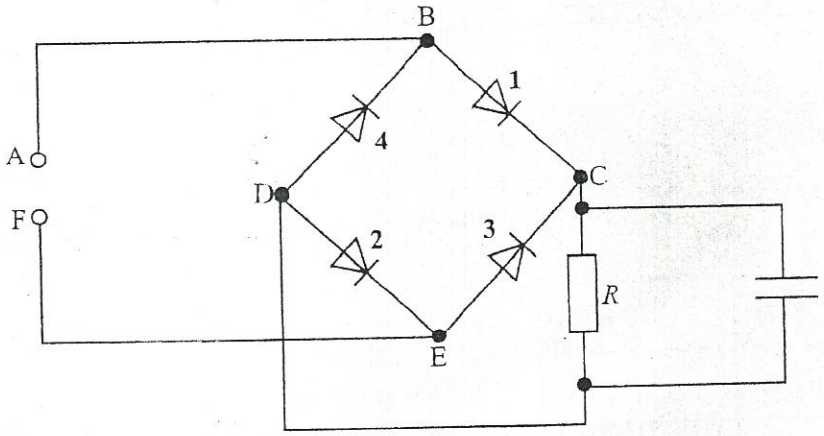


Diagram correct (smoothing capacitor) B1

If B is +ve 1 and 2 conducts B1

Current takes path CRD B1

If E is +ve 3 and 4 conducts B1

Current flows through CRD / current maintains flows in same direction B1

4 (a) (i)

A	B	Q
0	0	0
1	0	1
0	1	1
1	1	0

B1

(ii)

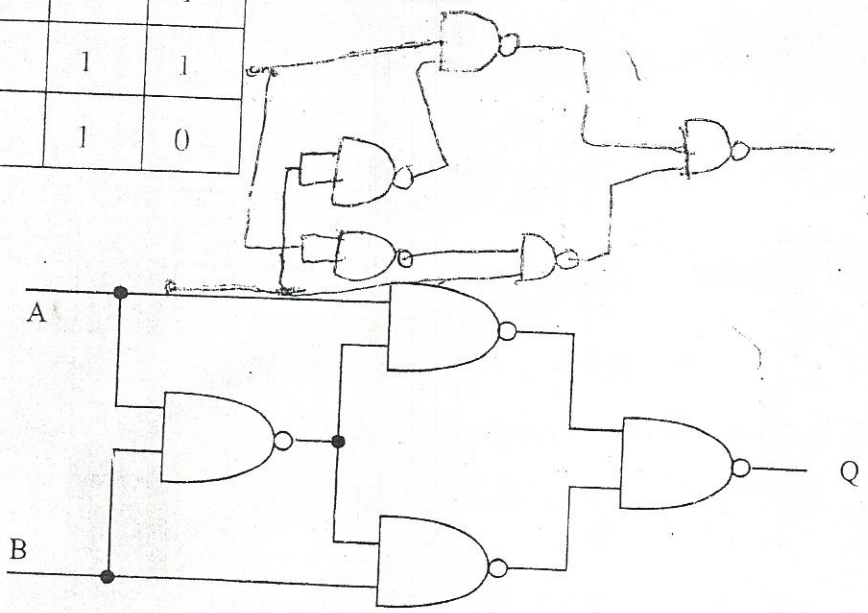


Fig. 4.1

Or any plausible alternative

Correct — B2
If incorrect — B0

(b)

A	B	C	D	E	F	G
0	0	0	0	1	0	1
0	0	1	0	1	0	1
0	1	0	0	0	1	1
0	1	1	0	0	1	0
1	0	0	0	1	0	1
1	0	1	0	1	0	1
1	1	0	1	0	0	1
1	1	1	1	0	0	1

max B6
-1 for each wrong row down to zero
(N.B, a simple NAND truth table scores only B1)

-1 for each incorrect/missing column for cases where some columns are missing.

C, Internet, B1

Cellphones B1

Satellites or any plausible reason social networks. B1

Skype

5 (a) (i) conduction

B1

convection

B1

(ii) conduction: involves movement of particles in heat transfer atoms vibrate and electron diffusion. B1

radiation: involves electromagnetic waves no need for a material medium / radiation is faster than conduction B1

(b) (i) amount of heat energy needed (per) unit mass to convert a liquid to gas at its boiling point / constant temperature B1 B1

(ii) well labelled diagram no need to label: jacket, condenser B3

OR

- electrical heat source + B1
- liquid container and heat jacket B1
- condenser and timer and mass measurement B1
- compensation for heat loss B1

(c) $Pt = ml + Q$

OR $Q = 60 \times 8 \times 60 - 50 \times 10^{-3} \times 4.3 \times 10^{5}$ C1

$= 7300J$ Reject heat loss per kg. A1