

# Pete Down Electronics Exam

## 14012022

*by Peter Zoltan Down*

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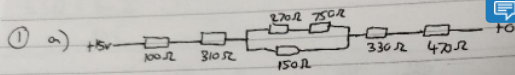
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# Electronics exam – Pete Down

Here are some additional words to persuade turnitin that this may possibly just be an actual submission which would be nice if it were to agree. QED or somesuch thing.

Electronics Exam

Pete D

① a) 

$$\frac{1}{R_{eq}} = \frac{1}{270 + 750} + \frac{1}{150}$$

$$= \frac{1}{1020} + \frac{1}{150}$$

$$= \frac{13}{1700}$$

$$R_{eq} = \frac{1700}{13}$$

$$= 130.769 \Omega \text{ (3d.p.)}$$

②

∴  $R_T = 100 + 310 + 330 + 470 + 130.769$   
 $= 1340.769 \Omega$

b) ~~15V~~ ~~100Ω~~ ~~310Ω~~ ~~150Ω~~ ~~330Ω~~ ~~470Ω~~ ~~10Ω~~

c)  $V = 15 \left( \frac{130.769}{1340.769} \right)$   
 $= 1.463 \text{ V}$

$I_T = \frac{V}{R}$   
 $= \frac{15}{1340.769} \text{ mA}$   
 $= 11.188 \text{ mA}$

$I_{R3} = \frac{1.463}{270}$   
 $= 5.419 \text{ mA}$

d)  $P = IV$   
 $= 11.188(15)$   
 $= 167.82 \text{ W}$

e)  $V_{R4} = 15 \left( \frac{330}{1340.769} \right)$   
 $= 3.692 \text{ V}$   
 $P = \frac{V^2}{R} = \frac{(3.692)^2}{330}$   
 $= 34.866 \text{ mW}$

f)  $R_T = 100 + 310 + 330 + 130.769$   
 $= 870.769 \Omega$

$I = \frac{V}{R}$   
 $= \frac{15}{870.769}$   
 $= 17.226 \text{ mA}$

D

② a) 100 ms/div 4 divs per wavelength

$$T = 4 \times 100 \text{ ms} = \underline{\underline{400 \text{ ms}}}$$

b)  $f = \frac{1}{T}$

$$= \frac{1}{400 \times 10^{-3}}$$

$$= \underline{\underline{2.5 \text{ Hz}}}$$

c) 500 mV/div. 4 divs

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$$\begin{aligned} V_{pk-pk} &= 500 \text{ mV} \times 4 \\ &= 2000 \text{ mV} \\ &= \underline{\underline{2 \text{ V}}} \end{aligned}$$

d)  $V_{RMS} = \frac{V_{pk-pk}}{\sqrt{2}}$

$$= \frac{2}{\sqrt{2}}$$

$$= \underline{\underline{0.707 \text{ V}}}$$

$$\textcircled{3} \quad V_C = V_0 \left( e^{-\frac{t}{RC}} \right)$$

$$R = 40,000 \, \Omega \quad C = 10 \times 10^{-6} \, \text{F} \quad V_0 = 12 \, \text{V}$$

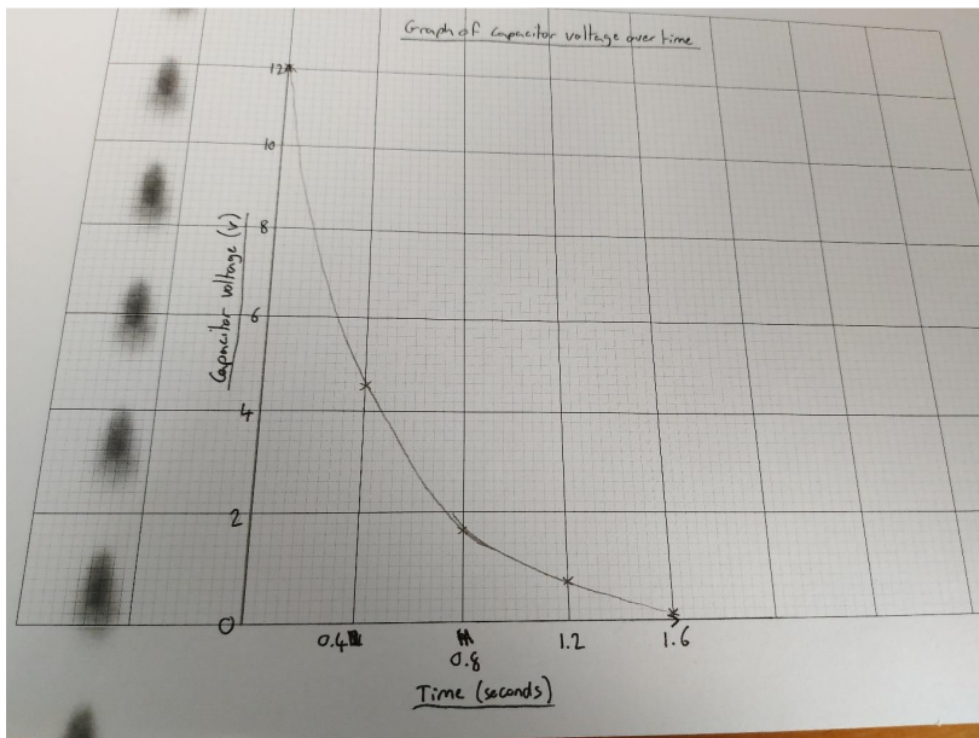
$$\text{a) } t = 1.6 \, \text{s}$$

$$V_C = 12 \left( e^{-\frac{1.6}{(40000)(10 \times 10^{-6})}} \right)$$

$$= \underline{\underline{0.220 \, \text{V} \, (3 \text{ d.p.})}}$$

b) See separate graph paper for graph

| $t \, (\text{s})$ | $V_C \, (\text{V})$ |
|-------------------|---------------------|
| 0                 | 12                  |
| 0.4               | 4.415               |
| 0.8               | 1.624               |
| 1.2               | 0.597               |
| 1.6               | 0.220               |



$$\begin{aligned}
 c) \quad E &= \frac{CV^2}{2} \\
 &= \frac{(10 \times 10^{-6})(12)^2}{2} \\
 &= \underline{\underline{0.72 \text{ mJ}}}
 \end{aligned}$$

$$d) \quad E = 0.1 \text{ mJ}$$

$$\begin{aligned}
 V &= \sqrt{\frac{2E}{C}} & V &= 4.473 \text{ V} \\
 &= \sqrt{\frac{2(0.1)}{10 \times 10^{-6}}} \\
 &= \sqrt{2000} \\
 &= 44.72 \text{ V}
 \end{aligned}$$

$$\begin{aligned}
 4) \quad a) \quad X_L &= 2\pi fL \\
 &= 2\pi(100)(200 \times 10^{-3}) \\
 &= 40\pi \, \Omega \\
 &= 125.664 \, \Omega \\
 X_C &= \frac{1}{2\pi fC} \\
 &= \frac{1}{2\pi(100)(5 \times 10^{-6})} \\
 &= 318.310 \, \Omega
 \end{aligned}$$

$$\begin{aligned}
 \therefore Z &= \sqrt{R^2 + (X_L - X_C)^2} \\
 &= \sqrt{(200)^2 + (125.664 - 318.310)^2} \\
 &= \underline{\underline{277.691 \, \Omega}}
 \end{aligned}$$

$$b) \quad I = \frac{V}{R}$$

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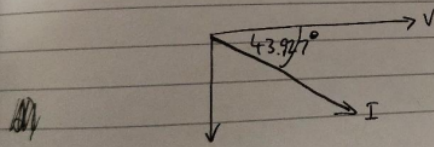
$$= \frac{V}{Z}$$

$$= \frac{20}{277.691}$$

$$= \underline{\underline{72.022 \text{ mA}}}$$

$$c) \tan^{-1} \left( \frac{X_L - X_C}{R} \right) = \tan^{-1} \left( \frac{125.664 - 318.310}{200} \right)$$

$$= \underline{\underline{-43.927^\circ}}$$



$$d) \cancel{V_R} V_R = 20 \left( \frac{200}{277.691} \right)$$

$$= \underline{\underline{14.404 \text{ V}}}$$

$$e) V = 20 \left( \frac{-318.310}{277.691} \right)$$

$$= -22.925 \text{ V}$$

$$|V| = \underline{\underline{22.925 \text{ V}}}$$

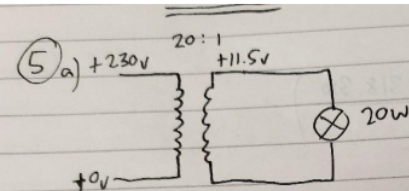
$$f) V = 20 \left( \frac{125.664}{277.691} \right)$$

$$= \underline{\underline{9.051 \text{ V}}}$$

$$g) F_0 = \sqrt{\frac{1}{4\pi^2 L C}}$$

$$= \sqrt{\frac{1}{4\pi^2 (200 \times 10^{-3}) (5 \times 10^{-6})}}$$

$$= \underline{\underline{159.155 \text{ Hz}}}$$

5) a) 

b) 
$$\frac{V_s}{230} = \frac{1}{20}$$
  

$$V_s = \frac{230}{20}$$
  

$$= 11.5 \text{ V}$$

$$P = IV$$
  

$$20 = 11.5 I$$
  

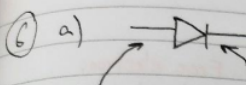
$$I = \frac{20}{11.5}$$
  

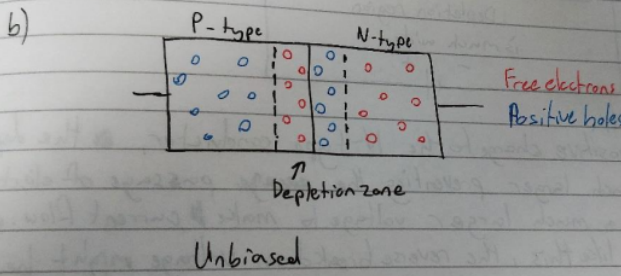
$$= 1.739 \text{ A}$$

c) 
$$\frac{I_p}{1.739} = \frac{1}{20}$$
  

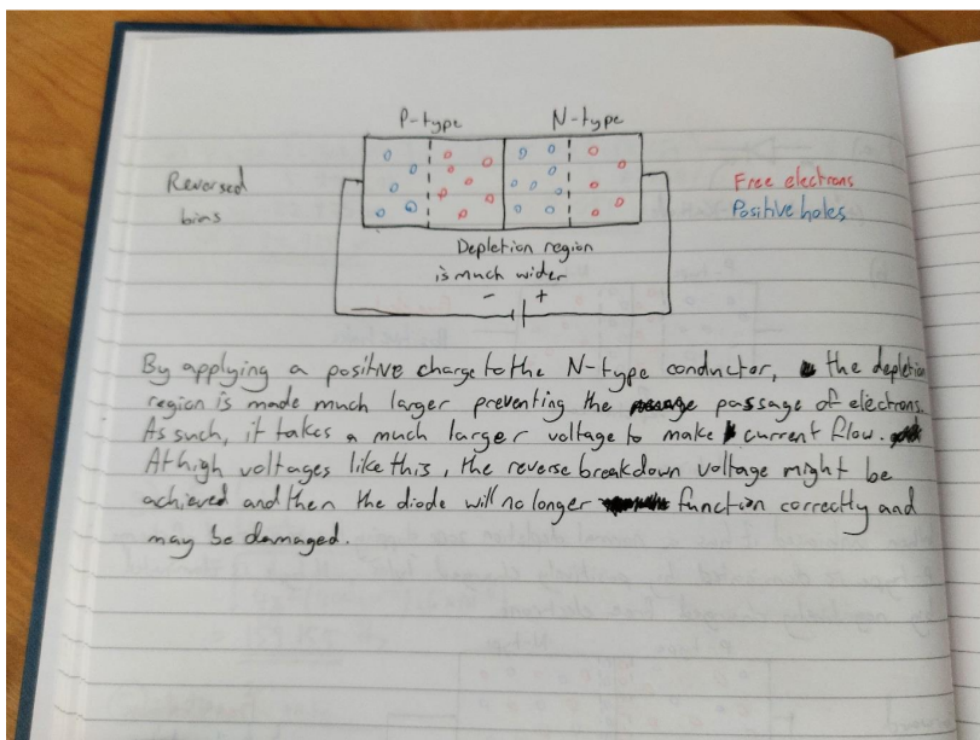
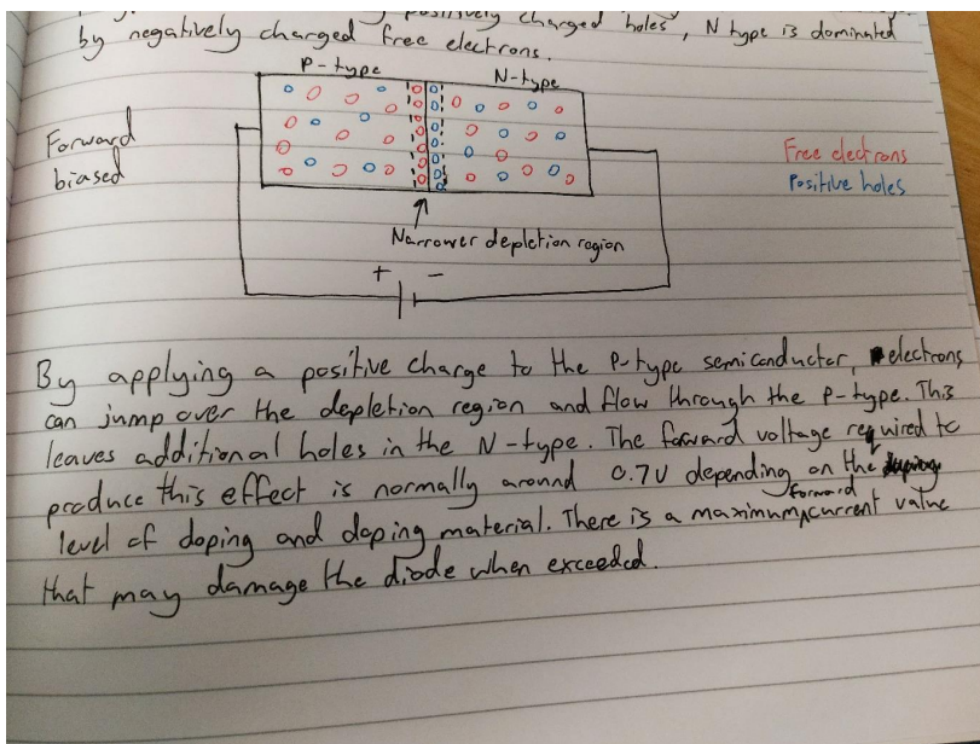
$$I_p = \frac{1.739}{20}$$
  

$$= 86.95 \text{ mA}$$

6) a)   
 (+) Anode (-) Cathode

b) 

When unbiased it has a normal depletion zone stopping the movement of charge. P-type is dominated by positively charged 'holes', N-type is dominated by negatively charged free electrons.



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## GRADEMARK REPORT

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FINAL GRADE

94/100

GENERAL COMMENTS

### Instructor

66 Marks out of 70

$66 / 70 \times 100 = 94\%$

Q1 - 16 Marks

a) 3 Marks

b) 2 Marks (Error Carried Forwards)

c) 1 Mark - wrong resistors chosen

d) 2 Marks (ECF)

e) 4 Marks (ECF)

f) 4 Marks (ECF)

Q2 - 5 Marks

a) 1 Mark

b) 1 Mark

c) 1 Mark

d) 2 Marks

Q3 - 13 Marks

a) 3 Marks

b) 5 Marks

c) 3 Marks

d) 2 Marks - needed time value

Q4 - 14 Marks

a) 2 Marks

b) 2 marks

c) 2 Marks

d) 2 Marks

e) 2 Marks

f) 2 Marks

g) 2 Marks

Q5 - 6 Marks

a) 2 Marks

b) 2 Marks

c) 2 Marks

Q6 - 12 Marks

a) 2 Marks

b) 10 Marks

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### Comment 1

Incorrect circuit layout

Resistance correct to your drawing.

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