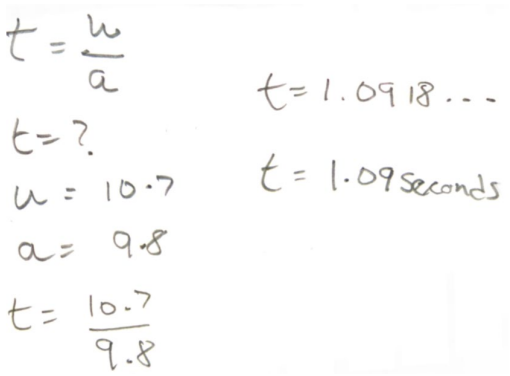
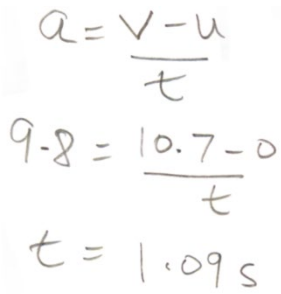
Q1(b) **Maximum mark: 3**

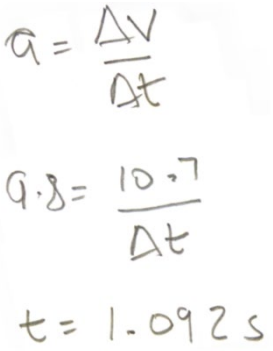
Response A **Marks**



Response B

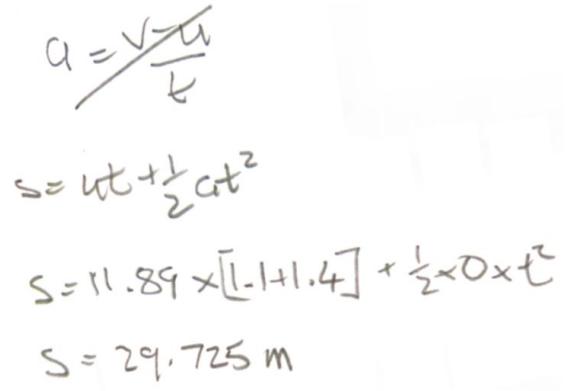


Response C

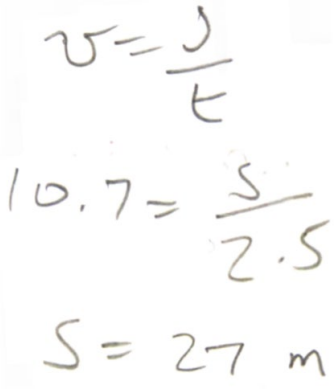


Q1(c) **Maximum mark: 3**

Response A **Marks**

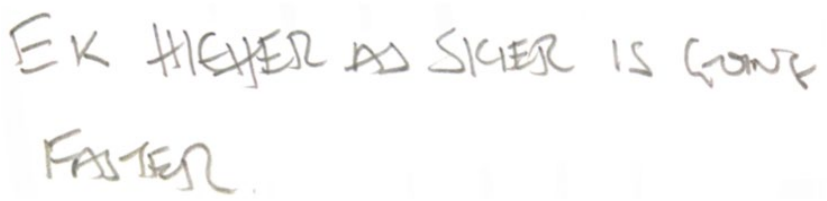


Response B

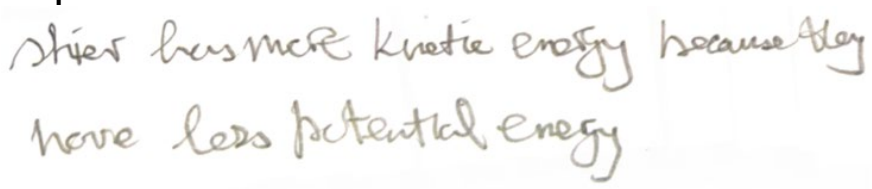


Q1(d) **Maximum Mark: 2**

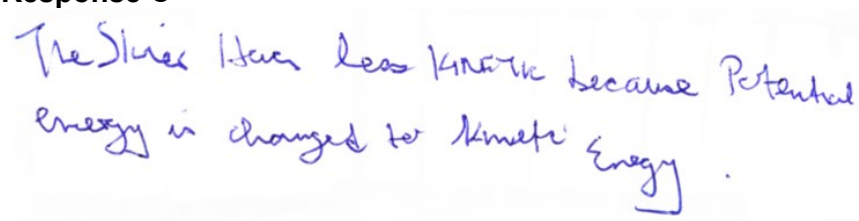
Response A **Marks**



Response B



Response C



Q2(a) **Maximum mark: 4**

Response A

Marks

$F = ma$

$F = 1.15 \times 10^5$ N

$m = 1.33 \times 10^5$ kg

$a = ?$

$a = \frac{m}{F}$

$a = \frac{1.33 \times 10^5}{1.15 \times 10^5}$

$a = 1.1565...$

$a = 1.16$ ms^{-2}

$F_T = ma$

$F_T = ?$

$m = 3.56 \times 10^4$

$a = 1.16$

$F_t = 3.56 \times 10^4 \times 1.16$

$F_t = 41180$ N

Response B

total mass $= 133.1 \times 10^3$ kg

$F = ma$

$1.15 \times 10^5 = 133.1 \times 10^3 \times a$

$a = \frac{1.15 \times 10^5}{133.1 \times 10^3} = 0.86$ ms^{-2}

$F = ma$

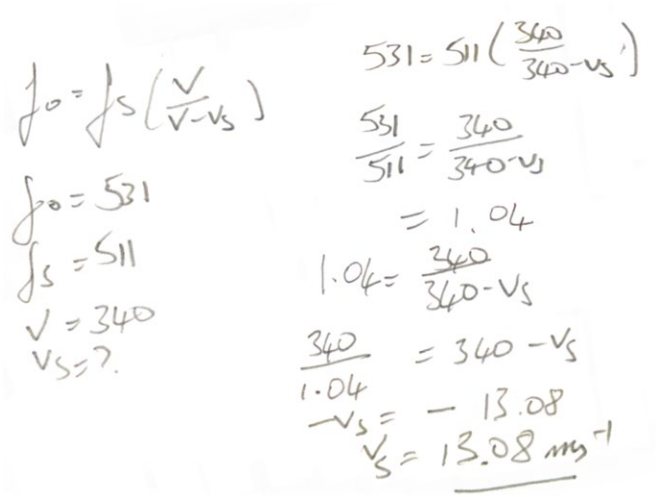
$= 3.56 \times 10^4 \times 0.86$

$= 30.6 \times 10^3$ N

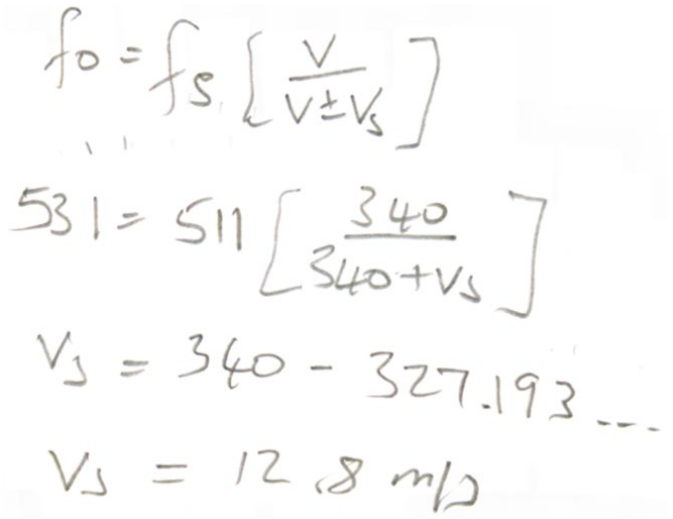
Q2(b)(i) Maximum mark: 3

Response 1

Marks



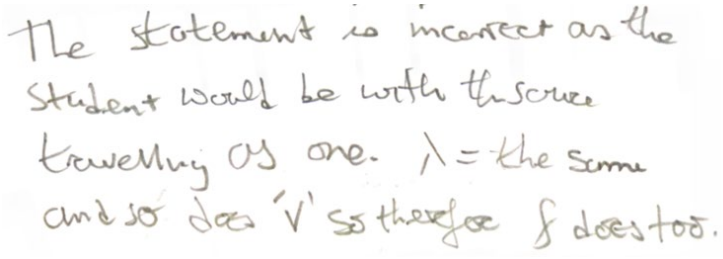
Response 2



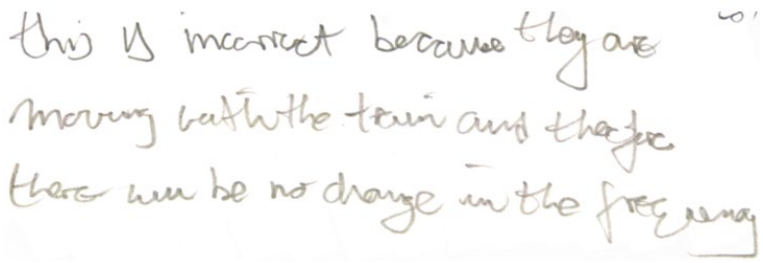
Q2(b)(ii) Maximum mark: 2

Response A

Marks

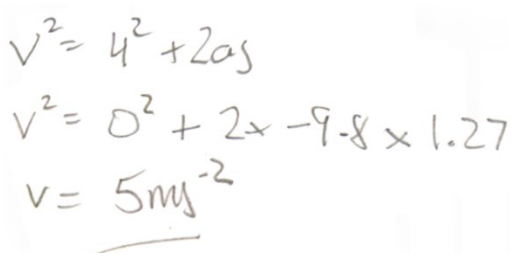


Response B

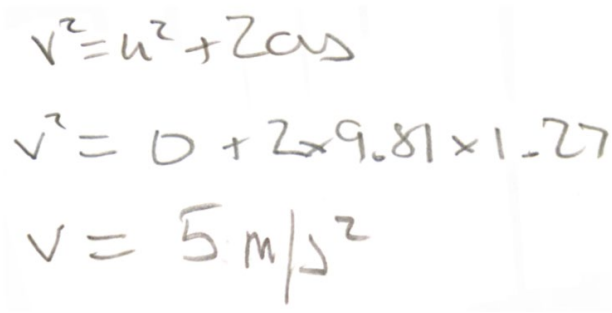


Q3(a) **Maximum mark: 3**

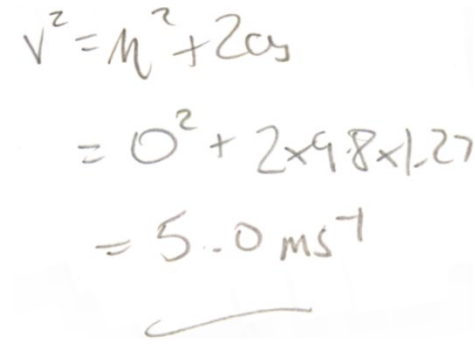
Response A **Marks**



Response B



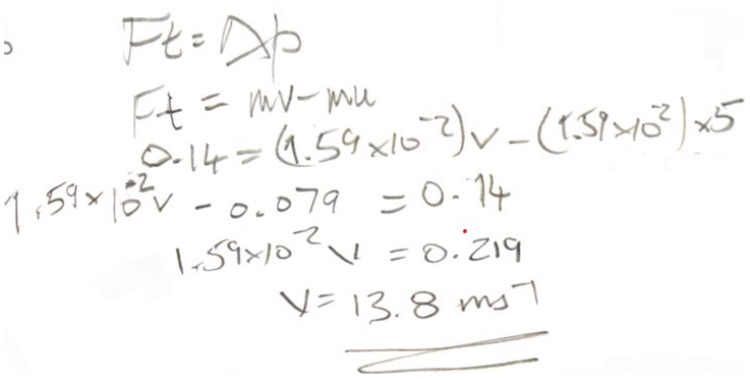
Response C



Q3(b) **Maximum mark: 3**

Response A

Marks



Q3(c) **Maximum mark: 1**

Response A **Marks**

Energy is lost in collision

Response B

Ek goes down and Ep goes up

Response C

In collision Ek gets lost.

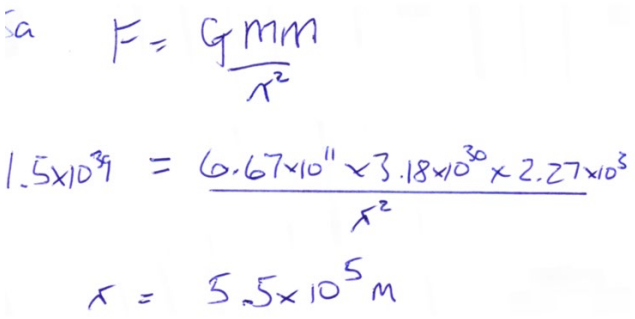
Q3(d) **Maximum mark: 2**

Response A **Marks**

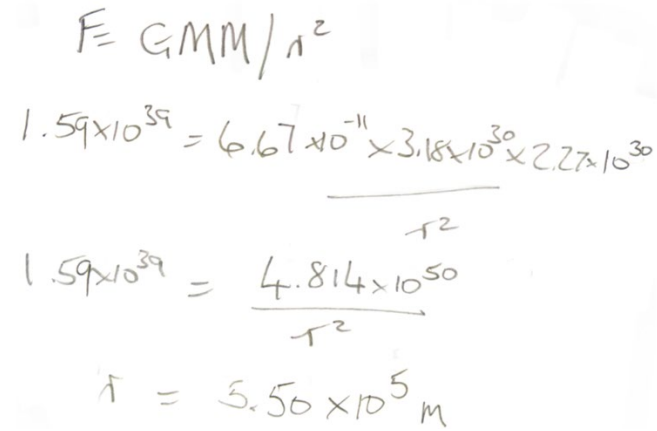
Response B

Q5(a) **Maximum mark: 3**

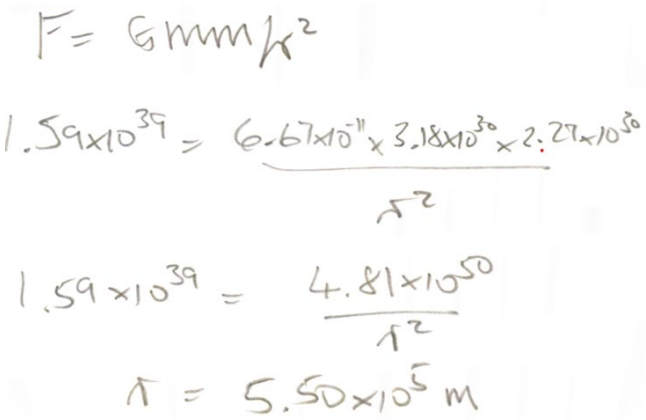
Response A **Marks**



Response B

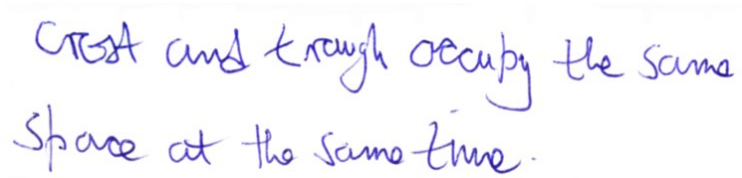


Response C

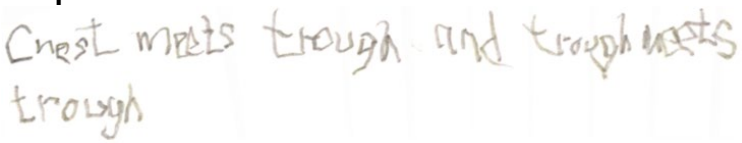


Q5(b)(i) **Maximum mark: 1**

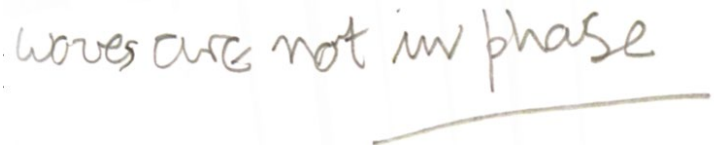
Response A **Marks**



Response B

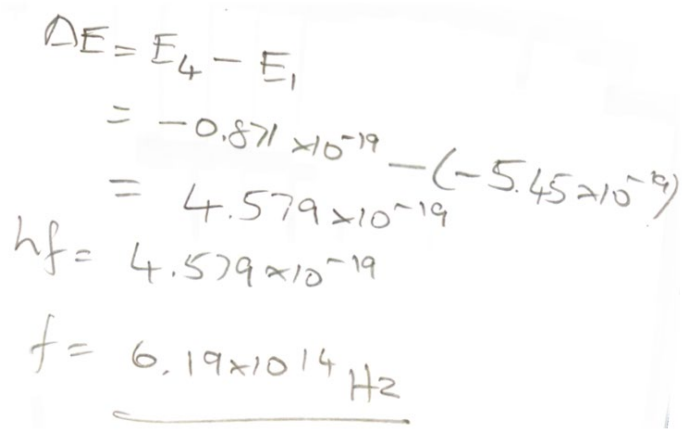


Response C

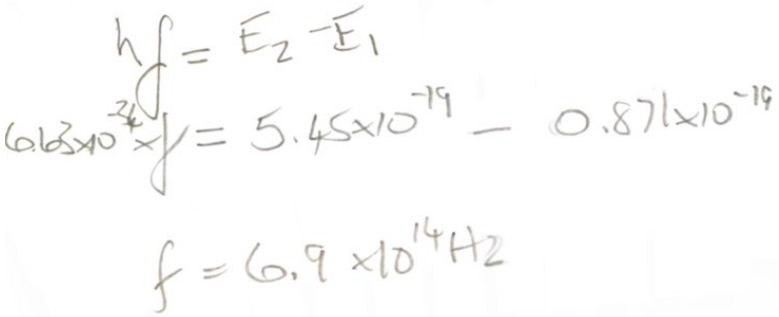


Q6(a)(i) Maximum mark: 3

Response A **Marks**



Response B



Q6(b) **Maximum mark: 3**

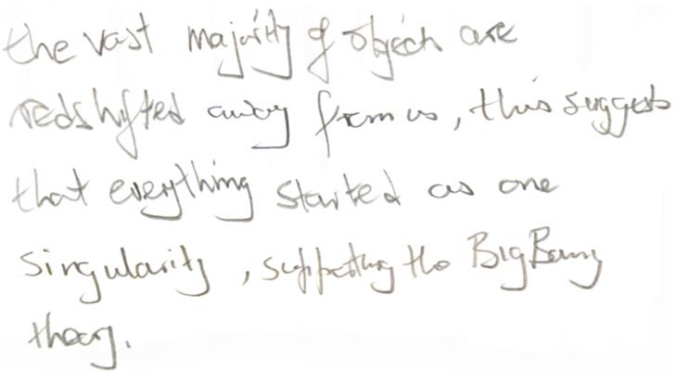
Response 1

Marks

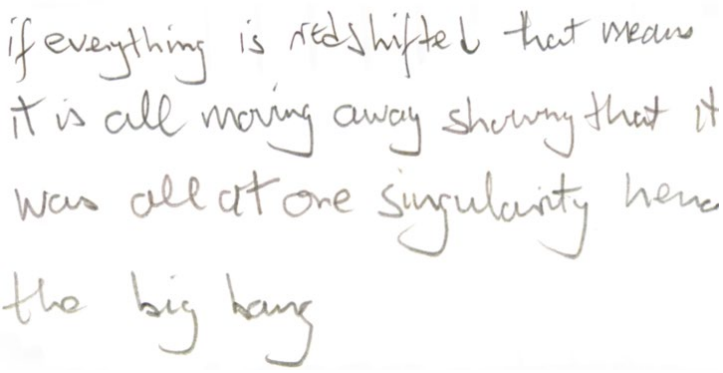
$$Z = \frac{V}{C} = \frac{4.51 \times 10^{6}}{3 \times 10^{8}} = 0.01500$$

Q6(c) **Maximum mark: 2**

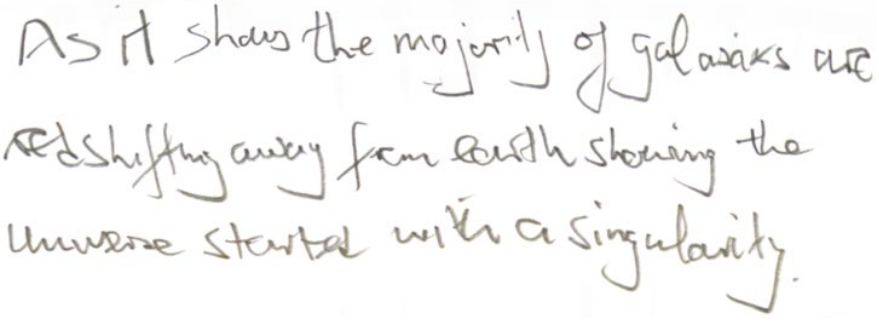
Response A **Marks**



Response B



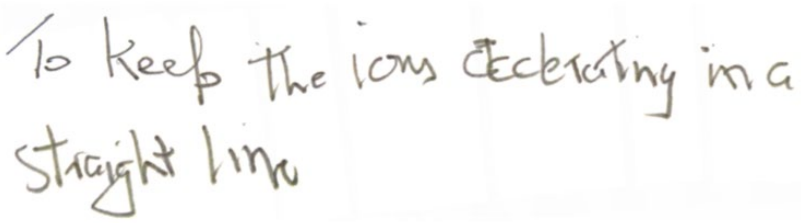
Response C



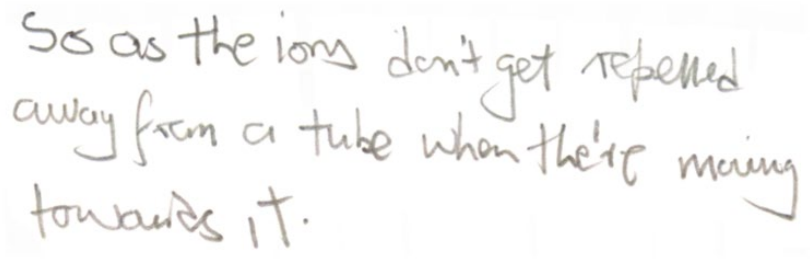
Q7(a)(i) Maximum mark: 1

Response A

Marks



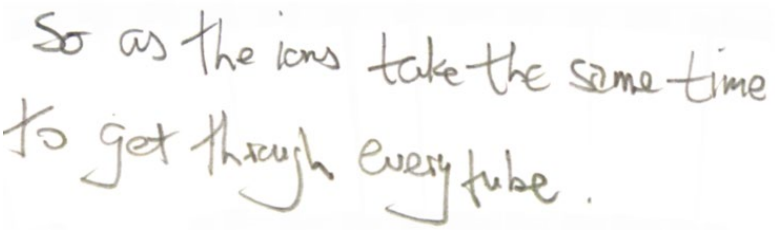
Response B



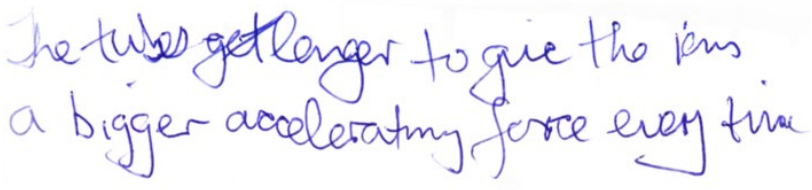
Q7(a)(ii) Maximum mark: 1

Response A

Marks



Response B



Q7(b) **Maximum mark: 3**

Response A **Marks**

$$\ell' = \ell\sqrt{\left(1-\frac{v^2}{c^2}\right)}$$

$$\ell' = 13\sqrt{1-\frac{0.5c^2}{c^2}}$$

$$\ell' = 9.2\ \text{m}$$

Response B

$$\ell' = \ell\sqrt{1-v^2/c^2}$$

$$\ell' = 13\sqrt{1-\frac{c^2}{4c^2}}$$

$$\ell' = 11.258\ \text{m}$$

Q8(a) **Maximum mark: 1**

Response A

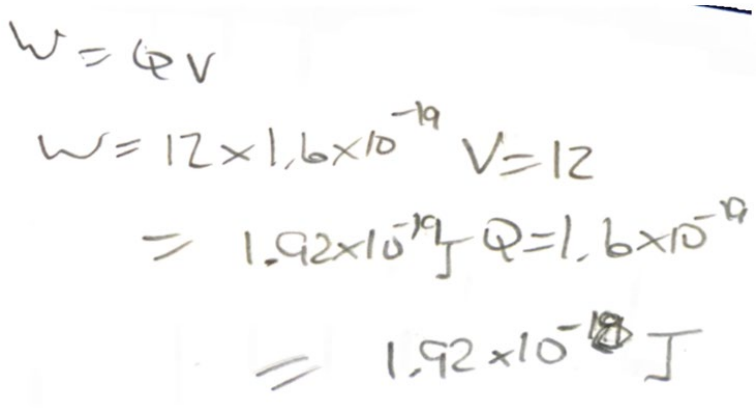
Marks

UV Photons have enough energy to eject electrons from the Plate White light Photons do not. Electrons cross from P to Q to Make a current.

Q8(b)(ii) Maximum Mark: 2

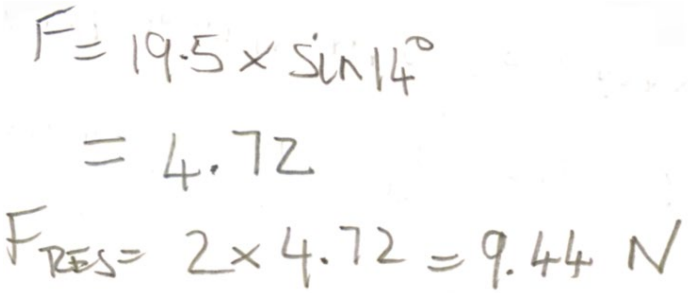
Response A

Marks

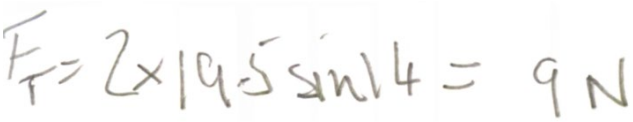


Q9(a)(i) Maximum mark: 2

Response A **Marks**

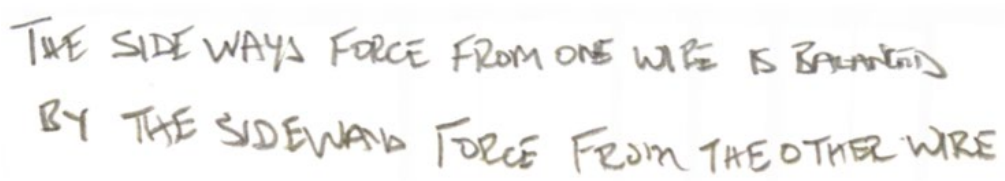


Response B



Q9(a)(ii) Maximum mark: 1

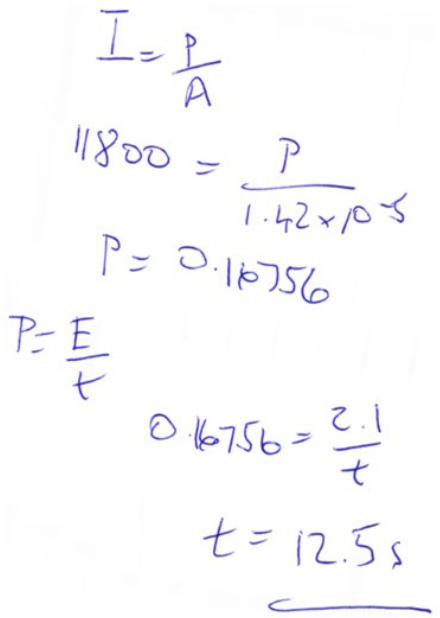
Response A **Marks**



Q9(b)(i) Maximum mark: 5

Response A

Marks



Q9(b)(ii) Maximum mark: 3

Response A

Marks

$6.3 \times 0.3^2 = 0.567$

$3.5 \times 0.4^2 = 0.56$

$2.3 \times 0.5^2 = 0.575$

$1.6 \times 0.6^2 = 0.576$

As the results are all similar the LED acts as a point source.

Response B

d	I	Id^2
0.30	6.3	0.567
0.40	3.5	0.56
0.50	2.3	0.575
0.60	1.6	0.576

$4 \overline{)2.278}$

0.5695

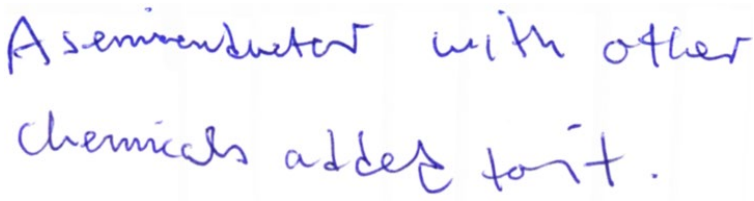
$Id^2 = 0.5695$

so LED is a point source

Q9(b)(iii)A Maximum mark: 1

Response A

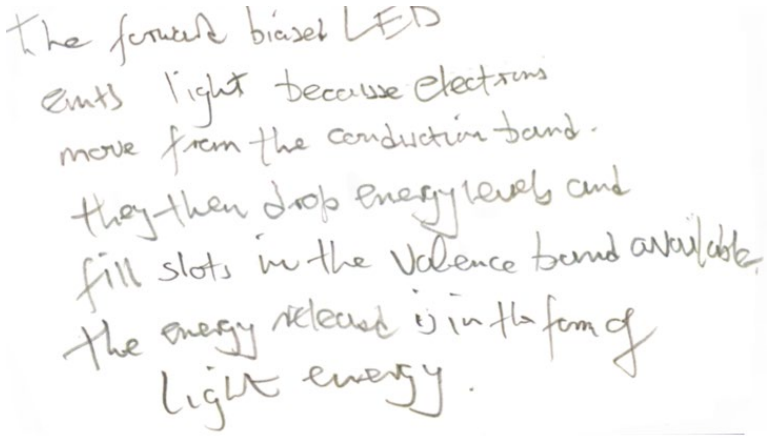
Marks



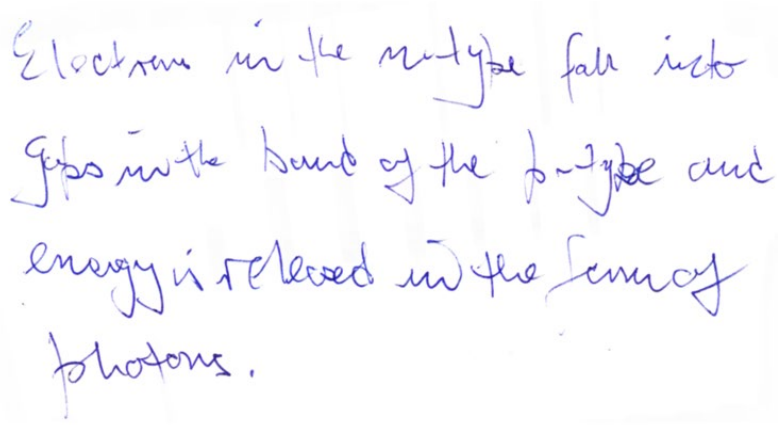
Q9(b)(iii)B **Maximum mark: 3**

Response A

Marks



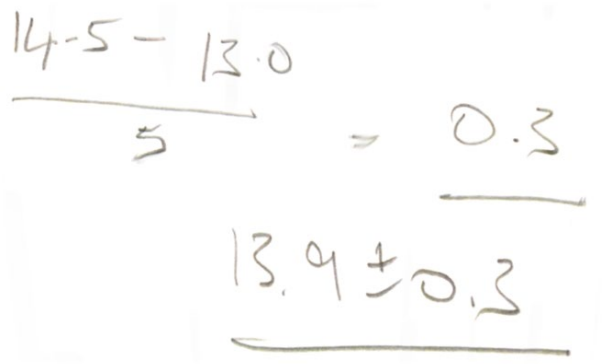
Response B



Q10(a)(i)B Maximum mark: 2

Response A

Marks



Q10(b) **Maximum mark: 1**

Response A **Marks**

The central maxima is white because the path difference is 0 therefore meaning the wavelengths stay the same.

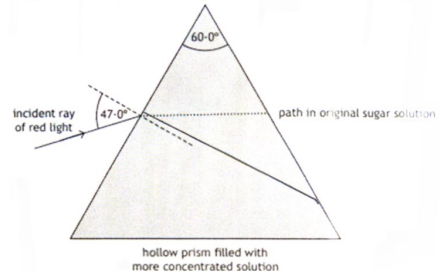
Response B

this is because the white light, when pass straight through the grating, will not defract because path difference is 0 as it is $= m\lambda$, where $m = 0$ (central maximum)

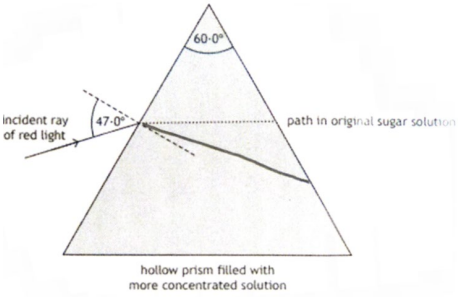
Q12(b) Maximum mark: 1

Marks

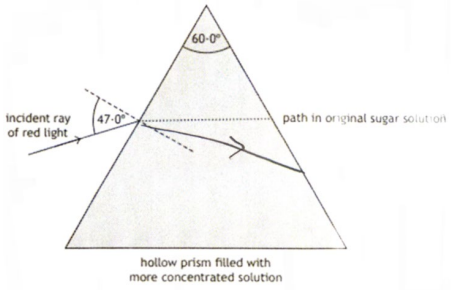
Response A



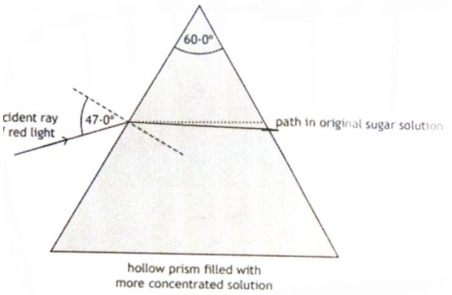
Response B



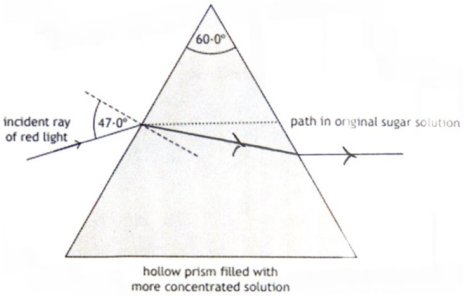
Response C



Response D



Reponse E



Q12(c) **Maximum mark: 2**

Response A **Marks**

the red light's wavelength is greater than that of green light within the spectrum.

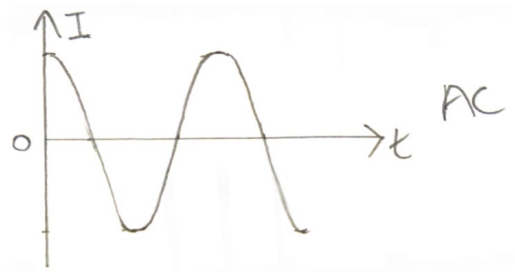
Response B

Green light is more refractive due to its shorter wavelength. red light has longer wavelength so its less refractive

Q13(a) **Maximum mark: 1**

Response A

Marks



Response B

alternating current changes direction. direct current flow in the same one direction all the time

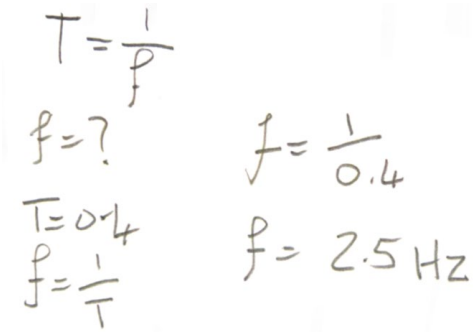
Response C

AC CHANGES DIRECTION WITH TIME

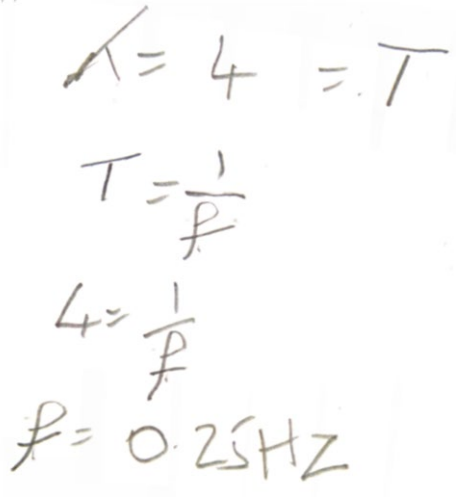
Q13(b)(ii) **Maximum mark: 3**

Response A

Marks



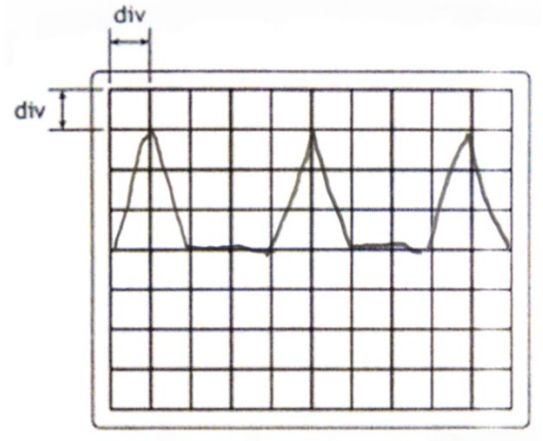
Response B



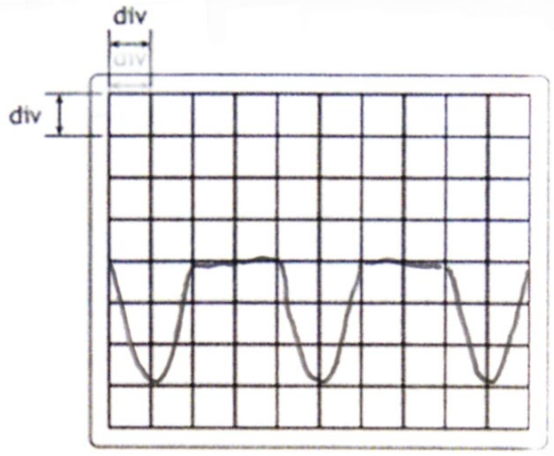
Q13(c) **Maximum mark: 2**

Response A

Marks



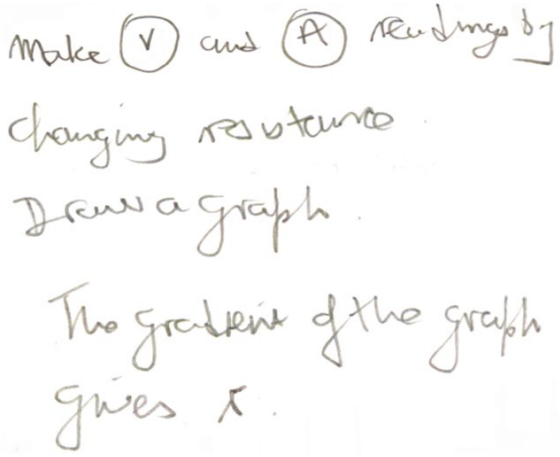
Response B



Q14(a) **Maximum Mark: 3**

Response A

Marks



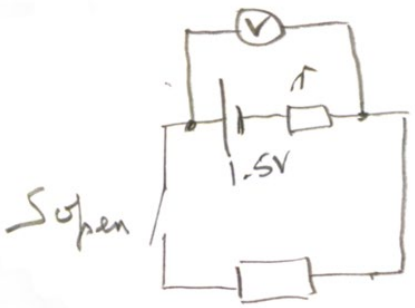
Q14(b)(i) Maximum mark: 1

Response A

Marks

1.5 J of energy is passed through 1 coulomb of charge in the circuit.

Response B

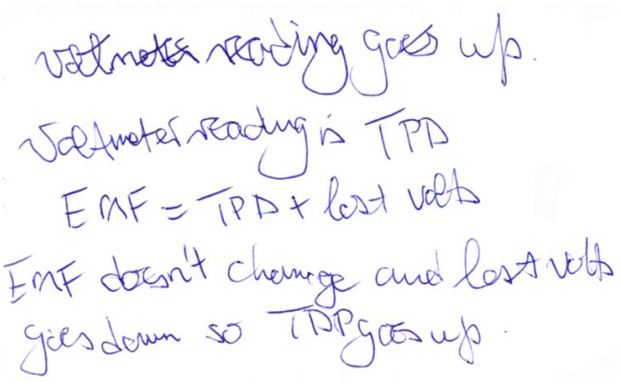


EMF 1.5V is the voltmeter reading

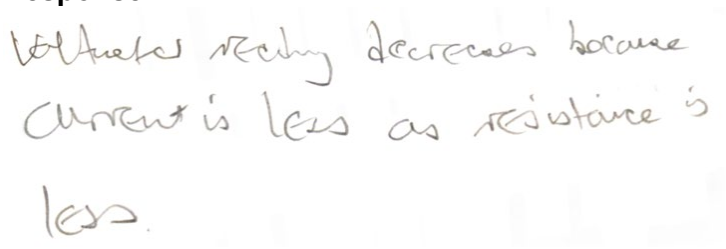
Q14(c) **Maximum mark: 3**

Response A

Marks



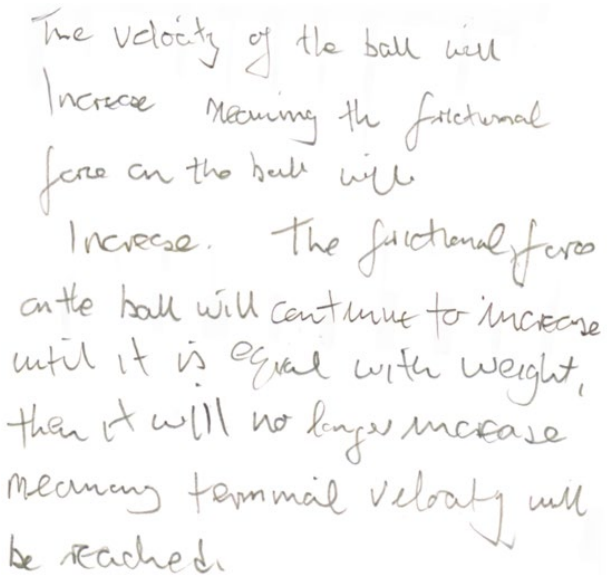
Response B



Q15(a) Maximum mark: 2

Response A

Marks



Response B