



SURNAME: Gibbs

FORENAME(S): Hayden George

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	2021185
2	Title of Examination Paper	Physics
3	Module Code	AC034007
4	Date and Time of Examination	10/01/2023 0900
5	Examination Venue	1Q310
6	Seat Number	056
7	Number of Answer Books handed in	

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

77 ~~AD~~
agreed!

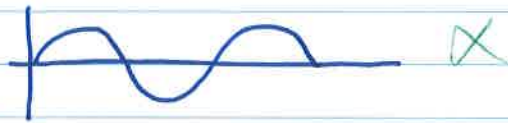
1)

- a) The Explosive is uniform.
Ends of Explosive grill are exposed.

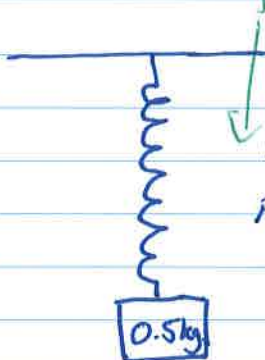
b)

- a) The resultant force is equivalent to the original force of a wave.
Sinusoidal wave form

$$\omega = 2\pi f$$



b)



$T = 1/f$
Spring constant = 500 Nm^{-1}
period of oscillation?

follow through

$$\begin{aligned}\omega &= \sqrt{k/m} \\ &= \sqrt{500/0.5} \\ &= 31.62 \text{ rad s}^{-1}\end{aligned}$$

$$2\pi f = \sqrt{500/0.5}$$

$$f = \frac{\sqrt{500/0.5}}{2\pi}$$

$$= 5.03 \text{ Hz}$$

$$\text{Period} = 1/f$$

$$= 1/5.03 = 0.1987$$

$$= 0.20 \text{ s}$$

2)

a)

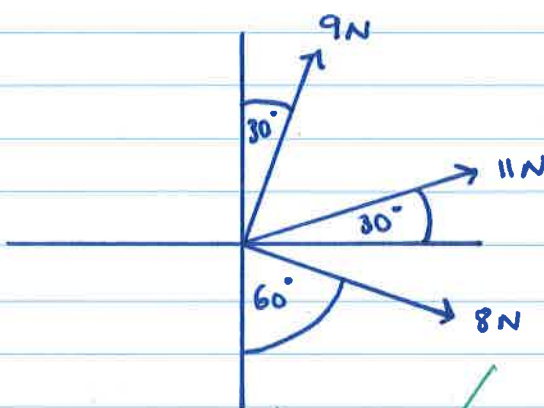
5 revolutions per minute

 $2\pi \times 5$ radians per minute

10.52 radians per minute

 $10.52 / 60$ radians per second $1/60$ or 0.52 radians per second

b)



$$F_H = 9 \cos(60) + 11 \cos(30) + 8 \cos(30)$$

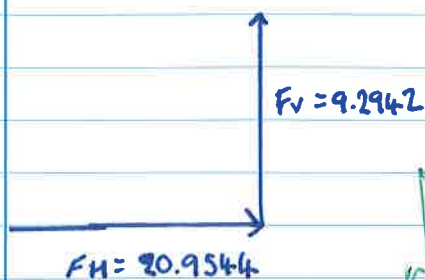
$$= 4.50 + 9.5263 + 6.9282$$

$$= 20.9544 \text{ N}$$

$$F_V = 9 \cos(30) + 11 \cos(60) - 8 \cos(60)$$

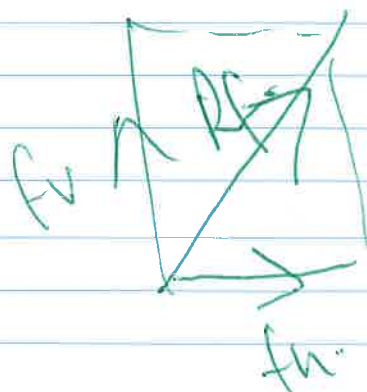
$$= 7.7942 + 5.50 - 4.00$$

$$= 9.2942 \text{ N}$$



$$F_R = \sqrt{20.9544^2 + 9.2942^2}$$

$$= 22.92 \text{ N}$$



3)

a) Ideal gas $P_1 = 8 \times 10^5 \text{ pa}$
 $V_1 = 0.2 \text{ m}^3$

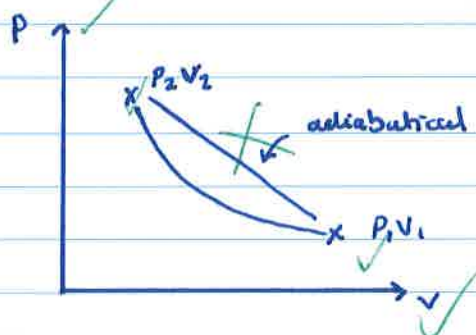
Compressed isothermally (no change) to $V_2 = 0.001 \text{ m}^3$
 $P_2 = ?$

$$V_1 P_1 = V_2 P_2$$

$$(0.2)(8 \times 10^5) = (0.001)(P_2)$$

$$P_2 = (0.2)(8 \times 10^5) / 0.001$$

$$= 160,000,000 \quad \text{or} \quad 160 \text{ Mpa}$$

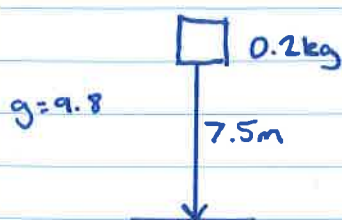


Adiabatically: The change happens so quickly, there is not enough time for the temperature to change. i.e., Shockwave.

b)

Body mass: 200g or 0.2 kg
 vertical height: 7.5m
 $g = 9.8 \text{ ms}^{-2}$

Speed at impact?



$$PE = mgh$$

$$= (0.2)(9.8)(7.5)$$

$$= 14.7 \text{ J}$$

$$PE = KE$$

3b)

Continued:

$$KE = \frac{1}{2}mv^2$$

$$14.7 = \frac{1}{2}(0.2)(v^2)$$

$$14.7 / \frac{1}{2}(0.2) = v^2$$

$$v^2 = 147$$

$$v = \sqrt{147}$$

$$v = 12.12 \text{ ms}^{-1}$$

- c) Projectile mass: 25g or 0.025kg
 Penetration depth: 0.4m
 Initial speed = 800ms⁻¹

$$KE = \frac{1}{2}mv^2$$

$$= \frac{1}{2}(0.025)(800^2)$$

$$= 8000 \text{ J}$$

$$\text{Work Done} = \text{Force} \times \text{Distance in direction of force}$$

$$\Delta KE = \text{Work Done}$$

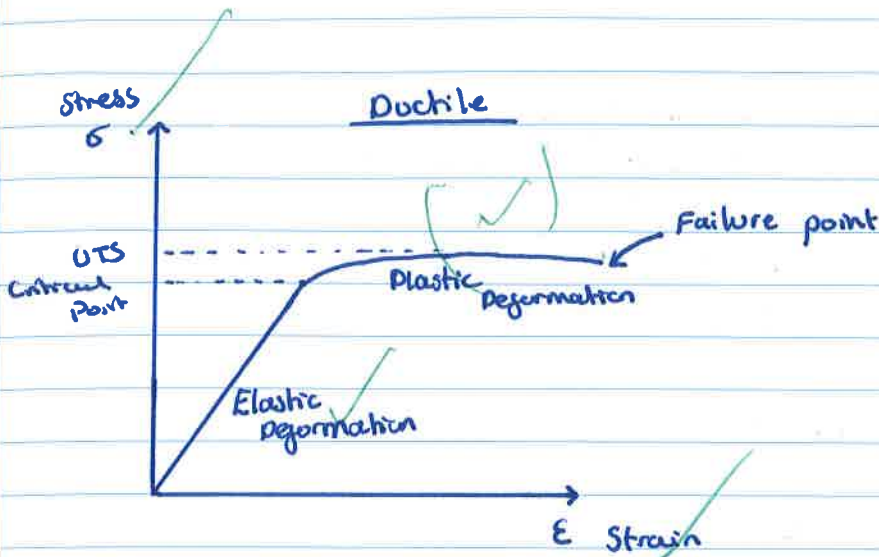
$$\therefore 8000 = \text{Force} \times 0.4 \text{ m}$$

$$F = 8000 / 0.4$$

$$= 20,000 \text{ N Resistive force}$$

4)

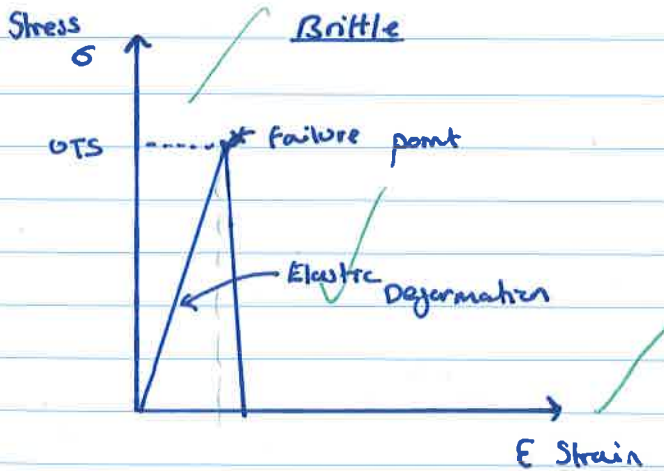
a)



UTS: Ultimate Tensile Strength

6

6



4

4

- b) change in length: $5 \times 10^{-3} \text{ m}$
Strain = 0.03

$$E = \text{Extension} / \text{original length}$$

$$0.03 = 5 \times 10^{-3} / \text{original length}$$

$$5 \times 10^{-3} / 0.03 = 0.17 \text{ m to 2 dp}$$

$$= 0.16 \text{ m}$$

$$\sigma = \frac{F}{A}$$

$$\epsilon = \frac{\Delta L}{L}$$

$$\epsilon \propto \sigma$$

~~0.17 m~~
~~0.16 m~~

~~0.17 m~~
~~0.16 m~~

Melting
OK

4)

- c) Modulus of Elasticity : $150 \times 10^9 \text{ pa}$
 Cross sectional area : 0.2 cm^2 or $0.2 \times 10^{-4} \text{ m}^2$
 Natural length : 2.5 m
 Suspended mass : 80 kg
 g : 9.8 ms^{-2}

Stress : ? Strain : ?

Stress = force / unit area

force = mass $\times$ Acceleration

$$= 80 \times 9.8$$

$$= 784 \text{ N}$$

Stress = F / A

$$= 784 / 0.2 \times 10^{-4}$$

$$= 39200000 \text{ Nm}^2 \text{ or pa}$$

$E = \text{Stress} / \text{Strain}$

$$150 \times 10^9 = 3.92 \times 10^7 / \text{strain}$$

$$3.92 \times 10^7 / 150 \times 10^9 = \text{Strain}$$

$$\text{Strain} = 2.61 \times 10^{-4}$$

$\frac{\text{Stress}}{\text{Strain}}$

4

6

20

19

5)

- a) Thermal energy can be transported through
 Convection, Infr-red (radiation), Heating elements
 Convection.

(2) 2

- b) Specific Heat Capacity: $300 \text{ J kg}^{-1} \text{ K}^{-1}$
 mass: 1.5 kg
 $\Delta T: 30 \text{ K}$

$$Q = mc\Delta T$$

$$= 1.5(300)(30)$$

$$= 13,500 \text{ J}, 13,500.00 \text{ J to 2 d.p.}$$

(7) 7

- c) Laser pulse Energy = 10 J
 time = 0.1 ms or $0.1 \times 10^{-3} \text{ seconds}$

$$10 / 0.1 \times 10^{-3} = 100,000 \text{ W}$$

(7) 7

(16)