



Examination Answer Book

24 Pages

Instructions to candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right and seal 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	P144283
2	Title of Examination Paper	MUNITIONS
3	Module Code	M6X00944
4	Date and Time of Examination	29/6/17 1100
5	Examination Venue	UWTSJ
6	Seat Number	

7	Number of Answer Books handed in	
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List the numbers of the questions you have attempted	Office Use
1	6.5
2	3
3	7
4	8
5	9.5
6	8
Total	45/40

Please complete this section and SEAL before the examination starts.

Surname HOLLOWAY Forename(s) CRAIG (Block Capitals)

Complete section, remove strip, fold as indicated and SEAL

1a) Passive ~~rely~~ missile systems rely on emissions from the target to seek, such as RF and IR.

Semi active missiles rely on seeking reflected emissions from a third party source such as a laser designator pod on another aircraft.

Active systems emit their own ~~method of~~ source for detection such as a RF transmitter on board.

b) They can be fire and forget, they are not reliant on ~~the~~ ~~from~~ a emitting source from the friendly system. As such, they are harder to detect.

c) INS

accelerometers - to detect changes in speed

gyroscopes - to detect changes in direction.

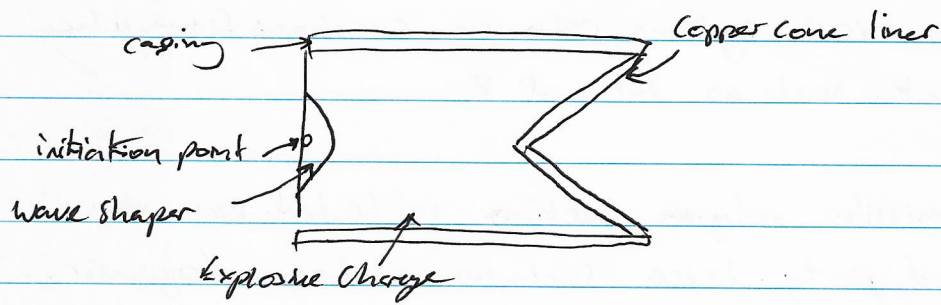
They have a method of gaining their initial launch location from the delivery platform. Any corrections required will be calculated by an on board computer to operate ~~the~~ control surfaces on the missile to alter direction.

2-5

1

3

2a)



The charge is initiated from the initiation point. The wave shaper ensures that the propagating wave hits the copper liner in such a way that it forms into a jet that acts hydrodynamically (like a fluid) to penetrate armour. This jet is then followed by the slug that provides behind armour effects.

b) The factors that affect the penetration are:

- Stand off distance - how far away it is from the target
- Cone shape - a shallow cone will make an EFP with a slug and little or no jet for penetration.
- Casing size and shape
- Charge size and type

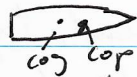
3a) impact - This type is initiated when the round makes physical contact with the target

Delayed - This has an inbuilt delay so it will initiate after a set time frame eg illumination rounds.

Proximity - This will initiate when it is close to the intended target.

b) ~~HE~~ HE rounds are typically green with yellow banding and illumination rounds are green with white banding.

Stability is achieved by taking into account the centre of gravity (COG) and the centre of pressure (COP). If the COP is forward of the COG then the round will be under stabilised and tumble.



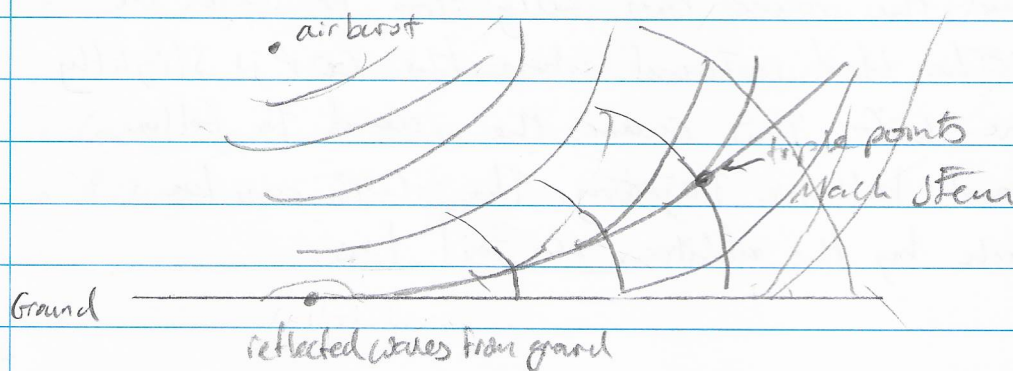
If the COG and COP are in the same place then the round can be over stabilised and the round can belly flop or land on its rear. The ideal is found when the COP is slightly behind the COG. This causes the round to follow the traditional ballistic trajectory. The COP can be moved back by the addition of tail fins.

4 a) ~~3a~~ Primary blast effects are sustained from the blast itself; the rapid expansion of gases and can cause injury to the lungs and guts.

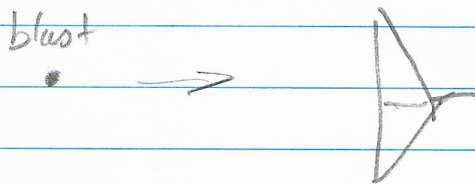
Secondary effects are from fragmentation either from the casing itself or from objects near and thrown by the blast.

Tertiary effects are sustained by being thrown into an object eg. wall or floor, by the blast.

b) Mach stem is formed when reflected blast waves catch up with incident blast waves. The reflected waves travel faster in the hot, post shock area behind the incident wave (the speed of sound is higher). This has an amplifying effect on the blast waves when they combine.



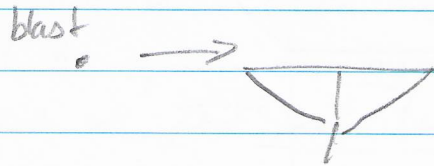
c) Reflected blast pressure waves are measured with the gauge face on to the pressure wave:



This wave will measure higher as the molecules hit the gauge, they will be compressed by the molecules following resulting in a higher reading. Incident blast gauges are set so the wave passes over the gauge and

not directly into it resulting in a lower reading.

2.5



$$5a) V_0 = \sqrt{2E} \left(\frac{M}{C} + \frac{1}{2} \right)^{-\frac{1}{2}} \quad \sqrt{2E} = \frac{VOD}{2.97}$$

$$i) \sqrt{2E} = \frac{8440}{2.97} \\ = 2841.75 \quad (\text{to 2 DP})$$

$$V_0 = 2841.75 \left(\frac{4.5}{6} + \frac{1}{2} \right)^{-\frac{1}{2}}$$

$$V_0 = 2541.74 \text{ m/s} \quad (\text{to 2 DP})$$



2

$$ii) \sqrt{2E} = \frac{9110}{2.97}$$

$$= 3067.34 \quad (\text{to 2 DP})$$

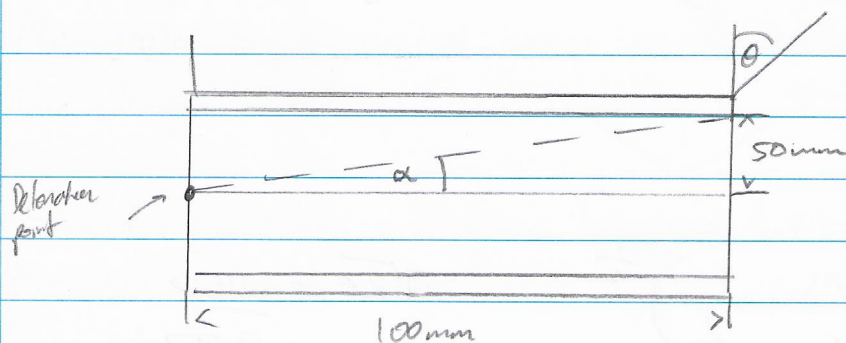
$$V_0 = 3067.34 \left(\frac{4.5}{6} + \frac{1}{2} \right)^{-\frac{1}{2}}$$

$$V_0 = 2743.51 \text{ m/s} \quad (\text{to 2 DP})$$

1.5

~~4/4~~

5b)



$$\alpha \tan = \frac{50 \times 10^{-3}}{100 \times 10^{-3}}$$

$$= 0.5$$

$$\alpha = 26.57^\circ \quad (2 \text{ DP})$$

$$\theta = \sin^{-1} \left(\frac{V_o \times \cos \alpha}{2D} \right) \quad \text{Where } V_o = 2541.74 \text{ m/s}$$

$$D = 8440 \text{ m/s}$$

$$\alpha = 26.57^\circ$$

$$= \sin^{-1} \left(\frac{2541.74 \times \cos 26.57}{2 \times 8440} \right)$$

$$= 7.74^\circ \quad (2 \text{ DP})$$

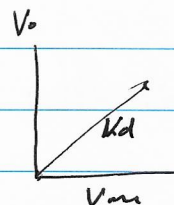
The beam angle at the near face will be straight up so the overall beam angle will be θ which is 7.74°

5c)

$$\text{using } V_d = \sqrt{(V_m^2 + V_o^2)}$$

$$= \sqrt{(420^2 + 2541.74^2)}$$

$$= 2576.21 \text{ m/s} \quad (2 \text{ DP})$$



(1)

6a) The nose part on a High Explosive Squash Head round is designed to squash on impact and spread the HE in a splat or part onto the surface of the armour.

①

b) The splat of HE as described in 6a) is then detonated. This caused a shock wave to propagate through the armour. When this wave meets the armour to air interface it ~~can~~ cannot propagate through into the lower density ^{air}. It ^{reflects} ~~reflects~~ back causing a tensile wave back. This causes the internal surface to ~~rip~~ scab or spall creating high velocity fragments inside the armour to cause casualties to the crew behind the armour.

⑦

