

PRIFYSGOL CYMRU

Y Drindod Dewi Sant

UNIVERSITY OF WALES

Trinity Saint David

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	P144275
2	Title of Examination Paper	MUNITIONS
3	Module Code	M6X00944
4	Date and Time of Examination	29/06/17 11:00
5	Examination Venue	SWANSEA
6	Seat Number	

	Number of Answer Books handed in	i
---	----------------------------------	---

[illegible]

FOLD

Complete
section,
remove
strip, fold as
indicated
and SEAL

Please complete this section and SEAL before the examination starts.

Neten Eliot

(Block Capitals) Forename(s)

Principi

Surname:

PATENT PENDING
INEOS AEE®

PATENT PENDING
INEOS AEE®

1. a) PASSIVE HOMING.

The missile sensors detect emission from the target vehicle (RF, Laser, Heat, sound, etc.) and use these received signals to guide the missile to the target.

SEMI - ACTIVE HOMING.

The missile relies on the target being illuminated from another source and receives the reflected signal to guide itself to the target.

ACTIVE - HOMING

The missile ~~itself~~ illuminates the target and uses the returns to calculate divergence angles to get to the target.

Requires an illuminating source, power supply, and guidance computer.

Often called 'fire and forget'

b) The advantage of using passive homing is that the missile has no electronic emissions, thereby being ~~blind~~ to countermeasures difficult to detect by countermeasures.

1. c

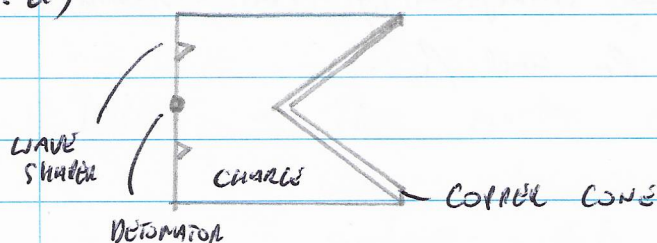
The main components of an INS are

Gyroscopes - measure rotational position

Accelerometers - measure motion in x, y, and z axis

3

2. a)



When the shaped charge is detonated a shock wave passes through the charge.

The wavershaper ensure that the ~~per~~ shock wave is focussed on the apex of the copper liner (cone)

The apex of the copper liner is forced forward hydrodynamically and forms a jet of molten copper.

As the shock wave moves through the charge the remaining copper forms the slug which follows the initial jet.

b) Shaped charge penetration can be affected by the size of the charge, the stand-off distance allowing the jet to form, the amount of copper to form the jet, and the angle of the cone. The shallower the angle the less jet and more slug.

c) The hydrodynamic penetration equation is
$$P_L \sqrt{\frac{\rho_c}{\rho_t}}$$

This is in essence the ratio of target density ρ_t and the charge density ρ_c .

If the charge density is increase i.e. it is in water rather than air then the penetration

observed will be significantly significantly less because
of the relationship of P_c and P_c .

3)a) The three firing systems found in mortars are

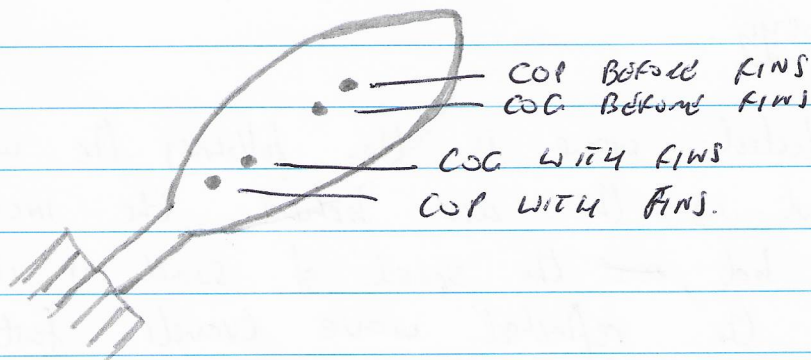
IMPACT - The mortar initiates as soon as it comes into contact with the target or surface. Acts instantaneously.

TIMED - The ~~firing~~ timing is set so the mortar initiates a ~~set~~ set time after leaving the barrel. Useful for smoke and illum.

MULTI-FUNCTION - The multifunction firing system can be used as a timer or a proximity fuse and can be set to initiate 2-6m above ground for maximum fragment effects.

b) HE rounds are dark green in colour with the ^{labelling} ~~writing~~ and ~~also~~ colour banding in yellow. Illumination rounds are coloured white.

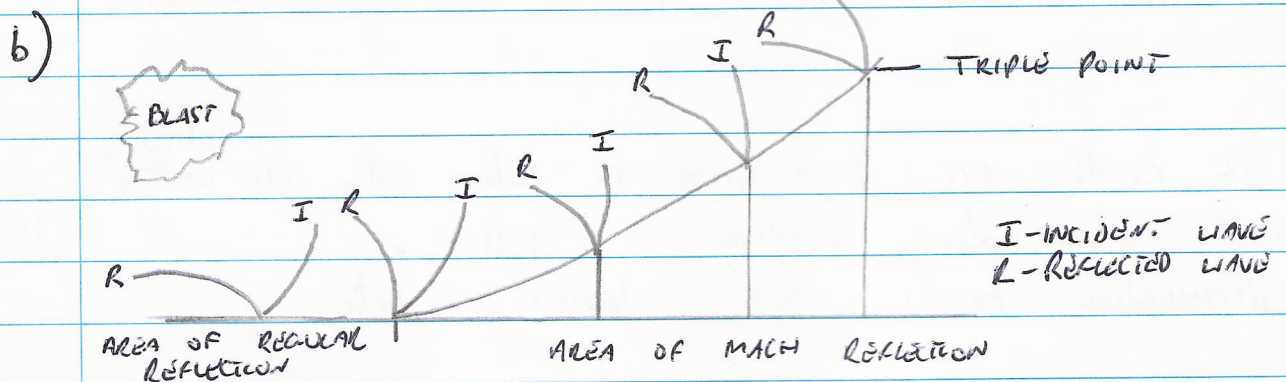
c) The mortar achieves dynamic stability by the addition of fins. This moves the centre of pressure behind the centre of gravity. Without the fins the mortar would be shorter and dynamically unstable and tumble in flight.



4) a) Primary blast effects cause damage to the gas filled organs of the body resulting in effects such as gas lung.

Secondary blast effects cause damage by the direct impacts of fragments on the body, or by the damage caused by the moving of objects like cars, bricks, glass, etc by the blast wave.

Tertiary blast effects result in damage caused by the moving of the human body and it being thrown into stationary objects.

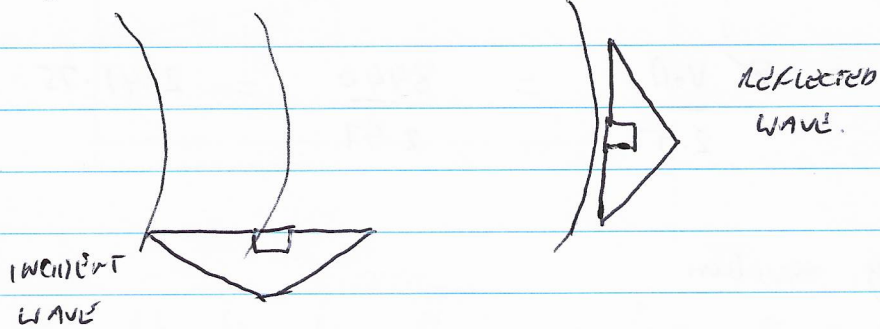


Mach stems occur when a charge is detonated ~~in~~ above ground. The incident wave moves directly away from the blast while the reflected wave is compressed on the ground. The compression of the air molecules in layer upon layer increases their energy.

The reflected wave is then following the incident wave, but as the air behind the incident wave is hot, ~~and~~ the speed of sound is increased and so the reflected wave travels faster and interacts with the incident wave increasing in force.

4)c)

If you look at pressure gauges



The incident wave passes ~~at~~ over the gauge.

The reflected wave hits the gauge and the air molecules are compressed by the layer above. The layers build up each compressing the ones below and so the amount of energy is subsequently increased.

2

5) a)

$$m = 4.5 \text{ kg}$$

$$c = 6 \text{ kg}$$

$$V_{0D} R_{0x} = 8440 \text{ m/s}$$

$$H_{0x} = 9110 \text{ m/s}$$

$$i) \sqrt{2E} = \frac{8 V_{0D}}{2.97} = \frac{8440}{2.97} = 2841.75 \text{ (2 d.p.)}$$

Using Gurney equation:

$$V = \sqrt{2E} \left(\frac{m}{c} + \frac{1}{2} \right)^{-\frac{1}{2}}$$

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

$$= 2841.75 \times (0.75 + 0.5)^{-\frac{1}{2}}$$

$$= 2841.75 \times 0.894$$

$$V_{R0x} = 2541.74 \text{ m/s} \quad (\text{to 2 d.p.})$$

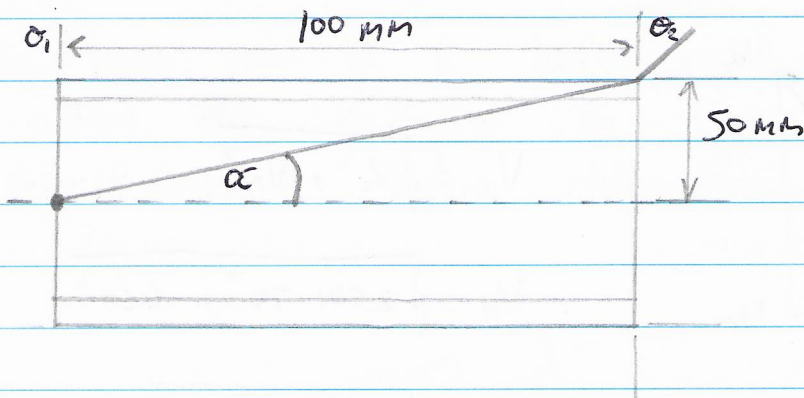
$$ii) \sqrt{2E} = \frac{9110}{2.97} = 3067.34$$

$$V = \sqrt{2E} \times 0.894$$

$$V = 3067.34 \times 0.894$$

$$V_{H0x} = 2743.43 \text{ m/s} \quad (\text{to 2 d.p.})$$

b)



As it deflects from the new face $\theta_1 = 0^\circ$

$$\tan \alpha = \frac{50}{100} \quad \text{so} \quad \alpha = \tan^{-1} \left(\frac{50}{100} \right) = 26.565^\circ$$

Using Turner Eqn.

$$\theta_2 = \sin^{-1} \left(\frac{V_0 \cos \alpha}{2D} \right) \quad \text{where } D = V_0 D$$

$$\theta_2 = \sin^{-1} \left(\frac{2541.74 \cos 26.565}{2 \times 8440} \right)$$

$$\theta_2 = \sin^{-1} \left(\frac{2541.74 \times 0.8944}{16880} \right)$$

$$\theta_2 = \sin^{-1} \left(\frac{2273.33}{16880} \right)$$

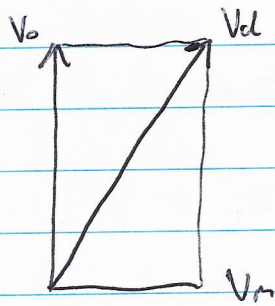
$$\theta_2 = \sin^{-1} (0.1347)$$

$$\theta_2 = 7.74^\circ \quad (\text{to } 2 \text{ D.P.})$$

Therefore the beam angle is 7.74°

5

5 c)



$$V_d = \sqrt{V_0^2 + V_m^2}$$

$$V_d = \sqrt{2541.74^2 + 420^2}$$

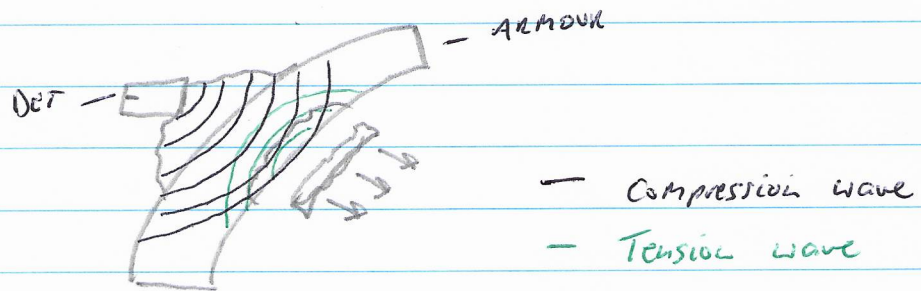
$$V_d = \sqrt{6636842.228}$$

$$V_d = 2576.21 \text{ m/s (to 2 dp).}$$

①

6) a) The nose part of a HESH round is malleable. This allows the explosive to spread out around the impact area before detonation. ①

b)



The HESH round impacts the target and the explosive charge spreads around the target area. The charge is initiated from the detonator at the rear of the charge.

The resulting explosion sets up a compression wave in the armour (black lines). When the wave-front reaches the armour/air interface the much less dense air restricts the progression of the wave. 69

Subsequently the wave is reflected back into the armour as a Tension wave. As the metal is much weaker in tension the energy causes a scab to be released from the inside face.

1/3 The first part of the book is a history of the world from the beginning of time to the present day. It is a very interesting and informative book.

The second part of the book is a history of the world from the present day to the future. It is a very interesting and informative book.

The third part of the book is a history of the world from the future to the end of time. It is a very interesting and informative book.

The fourth part of the book is a history of the world from the end of time to the beginning of time. It is a very interesting and informative book.

The fifth part of the book is a history of the world from the beginning of time to the end of time. It is a very interesting and informative book.

The sixth part of the book is a history of the world from the end of time to the beginning of time. It is a very interesting and informative book.

The seventh part of the book is a history of the world from the beginning of time to the end of time. It is a very interesting and informative book.

The eighth part of the book is a history of the world from the end of time to the beginning of time. It is a very interesting and informative book.

The ninth part of the book is a history of the world from the beginning of time to the end of time. It is a very interesting and informative book.

The tenth part of the book is a history of the world from the end of time to the beginning of time. It is a very interesting and informative book.