



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	P144280
2	Title of Examination Paper	Munitions
3	Module Code	M6X00944
4	Date and Time of Examination	29/6/17 1100
5	Examination Venue	
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	3.5
~~2~~	
3	3
4	8.5
5	10
6	7
2	4.5
Total	36.5

Please complete this section and SEAL before the examination starts.

Surname Wdnes Forename(s) Stephen (Block Capitals)

Complete section, remove strip, fold as indicated and SEAL

1a) Passive - relies on target given off its own ~~source~~ source i.e., IR, radiation.

Semi active - relies on a separate ~~source~~ source illumination the target which is sensed by the missile

Active - relies on having its own source to illuminate the target and responds to the reflected signature.

b) an operational advantage would be the missile is a fire and forget missile.

c)

x

3a) Impact fuze - ~~when sudden~~ ^{when a high forward motion} is detected ie, when the mortar hits an object it detonates.

Timedelay fuze - initially the same as the impact fuze but detonates a length of time after the impact.

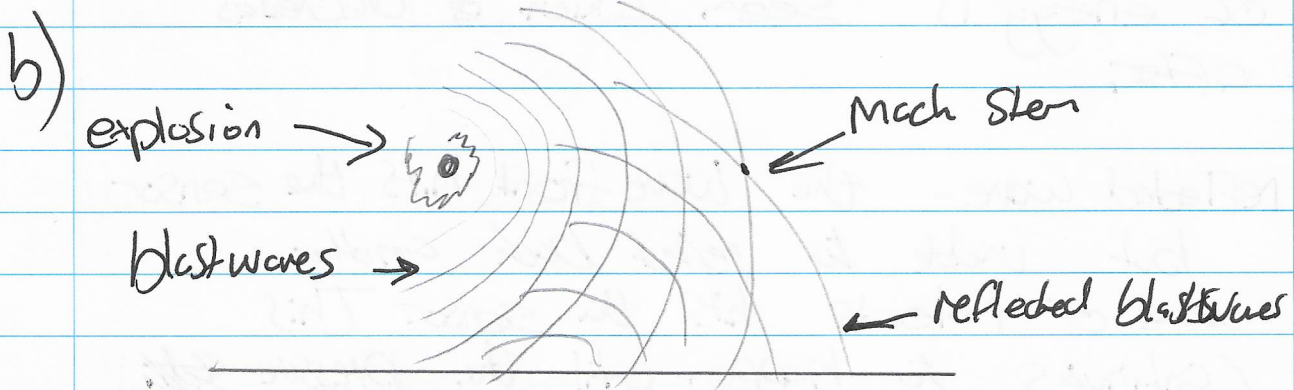
Proximity fuze - when the ~~prox~~ mortar is close to an object it is detected and detonates, does not need to make contact with object.

b) colour code for high explosive is white, illumination is yellow.

4) Primary - The effect of the high pressure air blast that will affect gas filled organs i.e. lungs. ✓

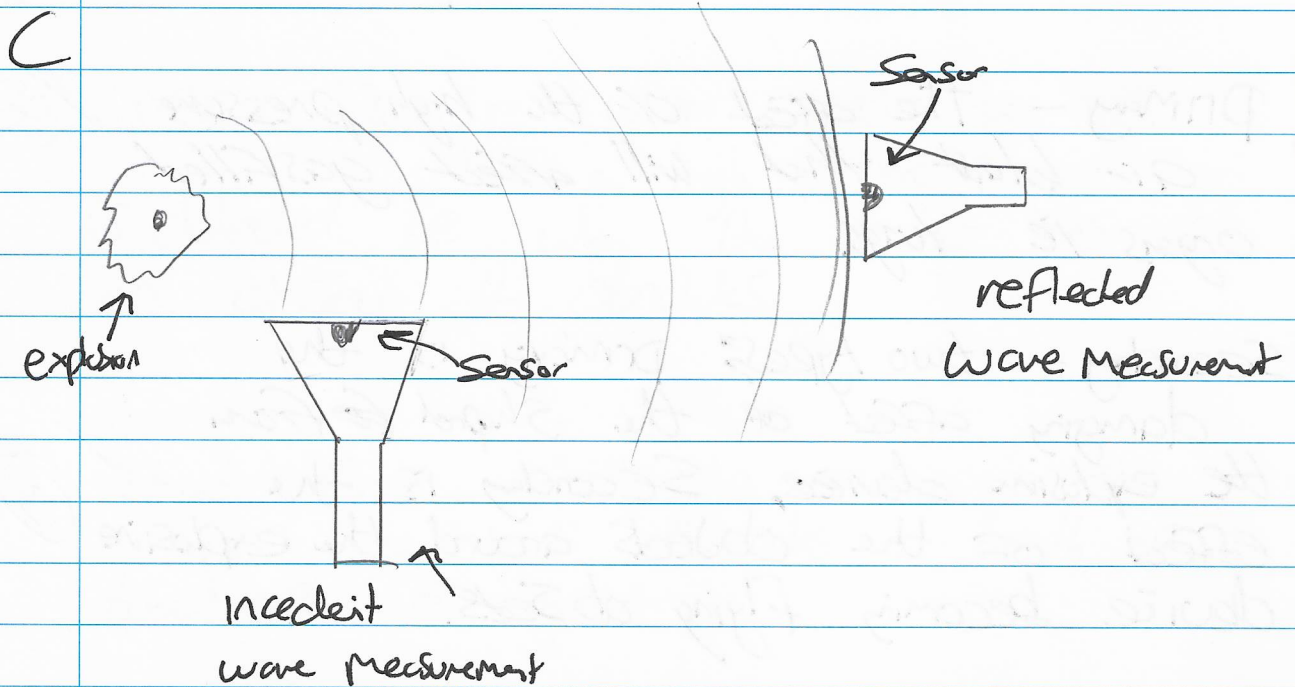
Secondary - two types? Primary is the damaging effect of the shock ~~from~~ from the explosion device. Secondary is the effect of the objects around the explosive device becoming flying objects. (3)

Tertiary - the effect of a human body being picked up by the blast and thrown into other objects close by. ✓



When an explosion happens the pressure wave is emitted from the explosion in a uniform manner outwards.

When the blast wave hits the ground it is reflected back up through the superheated area where the initial blast wave has gone with the blast wave traveling faster in a superheated environment the reflected wave catches up with the initial wave and ~~creates~~ creates a Mach stem creating a high pressure. (3)



Incident wave - When the ~~wave~~ Blast wave passes over the sensor a peak of energy is seen which ~~is~~ decreases after,

reflected wave - the wave front hits the sensor but unable to reflect back another wave of molecules hits the sensor. This continues to happen until the pressure ~~settles~~ stabilises and the energy at the surface is able expand out from the surface.

~~The energy is higher~~
The reflected energy is higher than incident energy because it has been compressed wave after wave of molecules ~~but it~~ so is the sum of the energy of the blast rather than ~~the~~ the peak.

5)

$$a_i) V_0 = \sqrt{2E} \left(\frac{M}{C} + \frac{1}{2} \right)^{-\frac{1}{2}} \quad \sqrt{2E} = \frac{V_{0D}}{2.97}$$

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

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

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

$$\sqrt{2E} = \frac{V_{0D}}{2.97} = \frac{8440}{2.97} = 2841.75 \text{ m/s}$$

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

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

$$V_0 = 2541.74 \text{ m/s}$$

②

$$a_{ii}) M = 4.5 \text{ kg}$$

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

$$V_{0D} = 9110 \text{ m/s}$$

$$\sqrt{2E} = \frac{V_{0D}}{2.97} = \frac{9110}{2.97} = 3067.34 \text{ m/s}$$

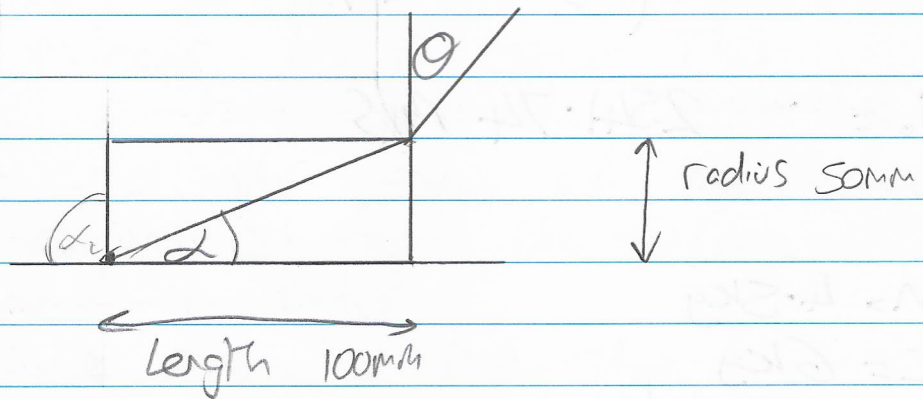
$$V_0 = \sqrt{2E} \left(\frac{M}{C} + \frac{1}{2} \right)^{-\frac{1}{2}}$$

$$V_0 = 3067.38 \left(\frac{4.5}{6} + \frac{1}{2} \right)^{-\frac{1}{2}}$$

$$V_0 = 2743.55 \text{ m/s}$$

b) $V_{0D} = 8440 \text{ m/s}$
 $V_0 = 2541.74 \text{ m/s}$
 length = 100mm
 radius = 50mm

$$\theta = \sin^{-1} \left(\frac{V_0 \times \cos(\alpha)}{2 \times V_{0D}} \right)$$



$$\tan \alpha = \frac{\text{opp}}{\text{adj}} \quad \therefore \alpha = \tan^{-1} \frac{\text{opp}}{\text{adj}}$$

$$\alpha = \tan^{-1} \frac{50}{100} = 26.57^\circ$$

$$\theta = \sin^{-1} \left(\frac{V_o \times \cos(\alpha)}{2 \times u_{od}} \right)$$

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

$$\theta = 7.74^\circ$$

The front beam angle is 7.74°
 The Rear beam angle is 0° with
 the detonation happening on the rear face.

This can be proved by assuming α is
 at 90° at the rear therefore:

$$\theta = \sin^{-1} \left(\frac{2541.74 \times \cos(90)}{2 \times 8440} \right)$$

$$\theta = 0^\circ$$

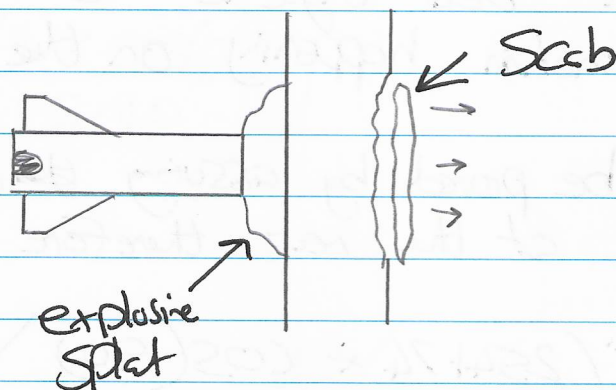
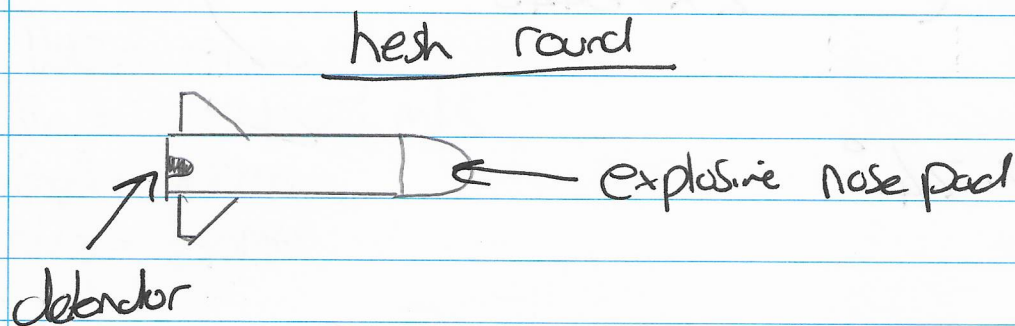
c) $V_d = ?$
 $V_o = 2541.74 \text{ m/s}$
 $V_m = 420 \text{ m/s}$

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

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

$$V_d = 2576.21 \text{ m/s}$$

- 6)
a) a nose pod of HESH Ammunition is designed to deform and make a splat of explosive on the surface of the object.



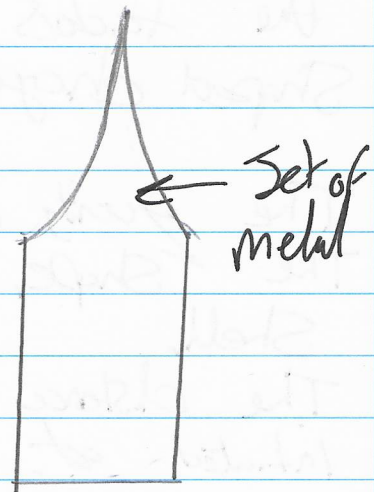
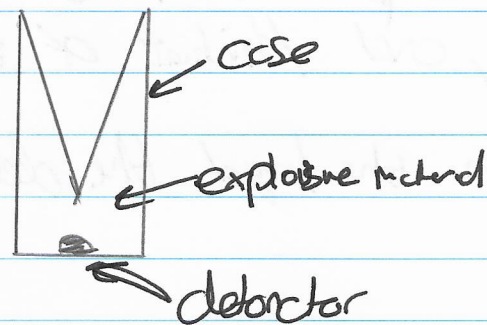
The Hesh round impacts onto the object, the nose creates a splat of explosives. The detonator activates which ~~detonates~~ detonates the explosive splat.

A pressure wave travels through the armour until it meets the surface under compression. The energy is unable to transfer into the air and is reflected back into the armour. This causes a tensile force within the armour with the two opposing forces, ~~and~~ This causes

the ~~op~~ inside surface to break away
CS & SCB from the armour.

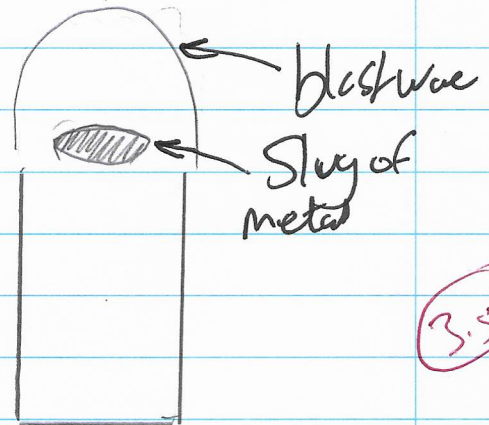
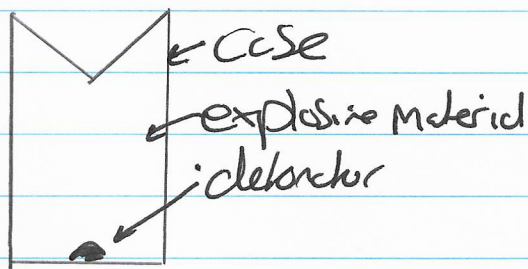
(6)

2a) Jet -



when the detonator activates the reaction travels
up the case and forms an energy ^{insulator}
wave that hydrodynamically changes the case
into ~~big~~ liquid and forms a liquid
jet of metal. this penetrates into
the object in its direction

Slug



(3.5)

When the explosive material is detonated
~~it does not~~ is not able to produce the
energy in a sufficient manner to create
a jet of metal. instead it forms a
slug of metal which is ejected from the
case slightly after the blast wave has
left the case.

b) the factors that can effect the Shaped charge Penetration are:

The quality of explosives in the device
The Shape, Size, and thickness of the Shell.

The distance from the target the device is initiated at.

