



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	P144279
2	Title of Examination Paper	Munitions
3	Module Code	M6X00944
4	Date and Time of Examination	29/06/2017 11.00
5	Examination Venue	
6	Seat Number	

7	Number of Answer Books handed in	6
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List the numbers of the questions you have attempted	Office Use
1	4.5
2	5.5
3	6
4	6.5
5	9.5
6	7
Total	30

Please complete this section and SEAL before the examination starts.

Surname CARTWRIGHT Forename(s) PAUL EDWARD (Block Capitals)

Complete section, remove strip, fold as indicated and SEAL

1) a)

Passive missile has no guidance it ~~reli~~ relies on the ballistic properties of the missile, this is dependant of the center of gravity and the center of pressure, the location of both ~~can depend~~ result in the missile being statically stable, statically unstable or Naturally stabilised.

Semi active missile need an external source to illuminate the target normally by IR or laser, the missile uses the laser reflected energy to guide its to the target

Active missiles are total autonomous and don't need external guidance, wance fired they will acquire, illuminate and guide them selfs to the target

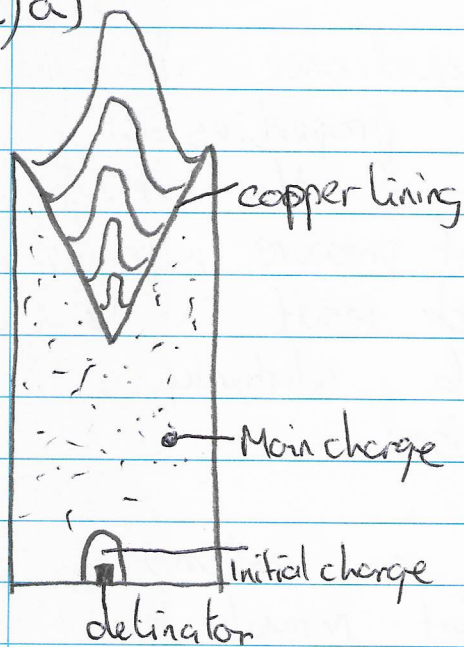
b)

Passive missile are cheaper to produce and don't need any complicated electronics. making them more reliable.

c) Inertial navigation system

GPS, Global Positioning receiver from satellites
Gyro, to keep it stable in flight.
EO or IR sensor, track reflected energy from lasers.
Hydraulics, to command fins

2) a)



The initial charge is detonated making the copper lining form into small wave, once the main charge is initiated this exacerbates the process keeping the copper in the wave formation by the time the copper has left the casing it is a molten mass of metal.

b) Factors of the shaped charge.

The larger the cone angle the less effective the charge. The material the cone is made of could require more energy to become molten. The type of casing could effect the forming slug and the main charge its self may not have enough energy to turn the lining into molten metal.

So 1, Cone angle

2, Material of cone

3, type of casing

4, Main charge material

5, stand of distance, to far from the target and it will be less effective.

c)

$$P = \frac{\rho L \sqrt{\frac{\rho_p}{\rho_t}}}{\sqrt{\rho_t}}$$

The depth of penetration is a ratio of the density of the material and the length of the penetrator

3) a)

Mortar fusing Airburst

air burst this is where the mortar is initiated several feet in the air to cause max frag damage or attacking trench positions, its also use to detonate the illumination & smoke round so they are more effective in different environments

(3.5)

Mortar fusing Impact

this is where the mortar initiates after a sudden loss in forward motion, like impacting the ground.

Mortar fusing delayed.

The mortar is set to initiate after a fraction of time, ~~like~~ this is use for dug in positions where the mortar can embed its self in the ground before initiation

b) The High explosive mortar is green with a yellow band, the illumination mortar is white with a brown band, The mortar barrel is a smooth bore with no rifling, The mortar ~~achieve dynamic stability~~ ^{is fired} using the charge weight/explosives place on its body the mortar achieves dynamic stability by small holes along its body which pass expelled gasses across the tail fins.

(1.5)

(1)

4) a

Primary blast

This causes sheer stress on the body, any gas filled pockets like the lungs or gut collapse,

Secondary blast

Primary - hit by the shell / casing

Secondary - hit by frag thrown up from the blast like stone, glass, wood.

Tertiary blast

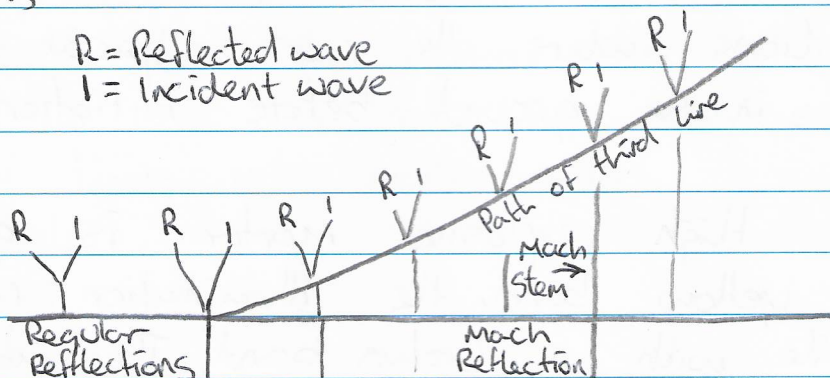
- this is where the body is lifted and thrown by the blast and the injuries are caused by the body coming to a sudden stop / hitting something.

b)

Mach stems



R = Reflected wave
I = Incident wave



c)

The mach stem is where the incident wave interacts with the reflected wave, Mach stem normal form when the detonation is above ground, the reflected wave rebounds off the ground traveling through the post hot shock air which is ~~is~~ ^{the} the speed of sound is high than at normal atmospheric pressure, the reflected wave catches up and interacts with the incident wave, the ~~incident~~ ^{reflected} wave is traveling faster than the incident wave meaning the blast pressures will be different

5)a)(i) using RDX ~~8840~~

$$\sqrt{2E} = \frac{VoD}{2.97} = \frac{8840}{2.97} = (2.9764) \text{ ms}^{-1}$$

(1.5)

$$V = \sqrt{2E \left(\frac{M}{C} + \frac{1}{2} \right)^{-\frac{1}{2}}} = 2.9764 \left(\frac{4.5}{6} + \frac{1}{2} \right)^{-\frac{1}{2}} = \underline{\underline{2662.17 \text{ ms}^{-1}}}$$

b)(i) $\tan^{-1} \left(\frac{50}{100} \right) = 26.565^\circ$

$$\Theta = \sin^{-1} \left(\frac{(Vo \times \cos(x))}{2D} \right) = \sin^{-1} \left(\frac{(2662.17 \times \cos(26.565))}{2 \times 8840} \right)$$

$$\Theta = \underline{\underline{7.74^\circ}}$$

c)(i) $Vd = \sqrt{Vo^2 + Vm^2} \quad Vd = \sqrt{2662.17^2 + 420^2} \quad \underline{\underline{Vd = 2695 \text{ ms}^{-1}}}$

5)a)(ii) using HMX 9110

$$\sqrt{2E} = \frac{VoD}{2.97} = \frac{9110}{2.97} = \underline{\underline{3.06734 \text{ ms}^{-1}}}$$

$$V = \sqrt{2E \left(\frac{M}{C} + \frac{1}{2} \right)^{-\frac{1}{2}}} = 3.0673 \left(\frac{4.5}{6} + \frac{1}{2} \right)^{-\frac{1}{2}} = \underline{\underline{2743.47 \text{ ms}^{-1}}}$$

(2)

b)(ii) $\tan^{-1} \left(\frac{50}{100} \right) = 26.565^\circ$

$$\Theta = \sin^{-1} \left(\frac{(Vo \times \cos(x))}{2D} \right) = \sin^{-1} \left(\frac{(2743.47 \times \cos(26.565))}{2 \times 9110} \right) =$$

$$\Theta = \underline{\underline{7.74^\circ}}$$

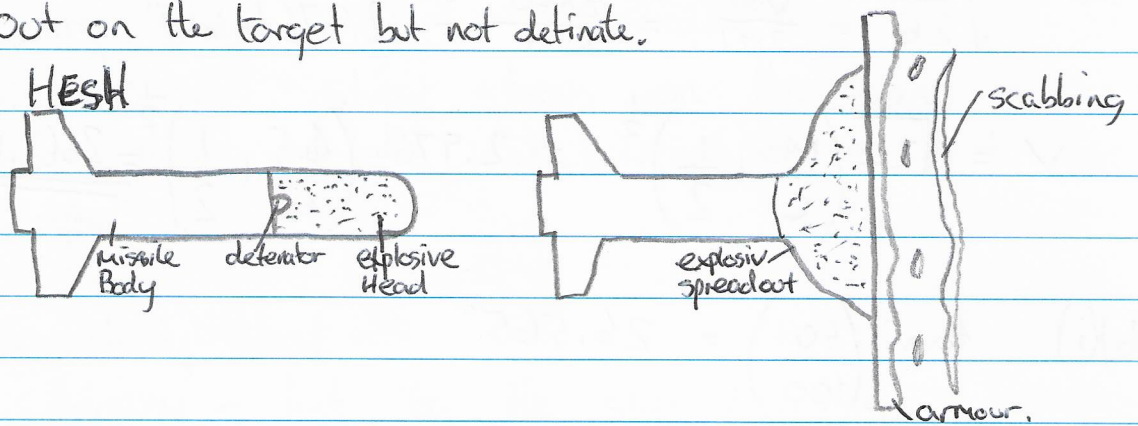
(5)

c)(ii) $Vd = \sqrt{Vo^2 + Vm^2} = \sqrt{2743.47^2 + 420^2}$
 $Vd = \underline{\underline{2775 \text{ ms}^{-1}}}$

(1)

6) a) Its to allow the explosive inside to slick and spread out on the target but not definate.

b) HESH



HESH work by the missile hitting the target the explosive splats on and detonates causing a compression wave to propagate through the armour until it hits an air gap the compression wave finds it hard to propagate through the low density air and reflects back as a tensile wave which causes the scabbing, which is what causes all the damage to person inside the armour.

