



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Complete, fold and seal
(see note 2 below)

SURNAME: SIMPSON

FORENAME(S): ALAN JOSEPH

Examination Answer Books

12 Pages

Instructions to Candidates

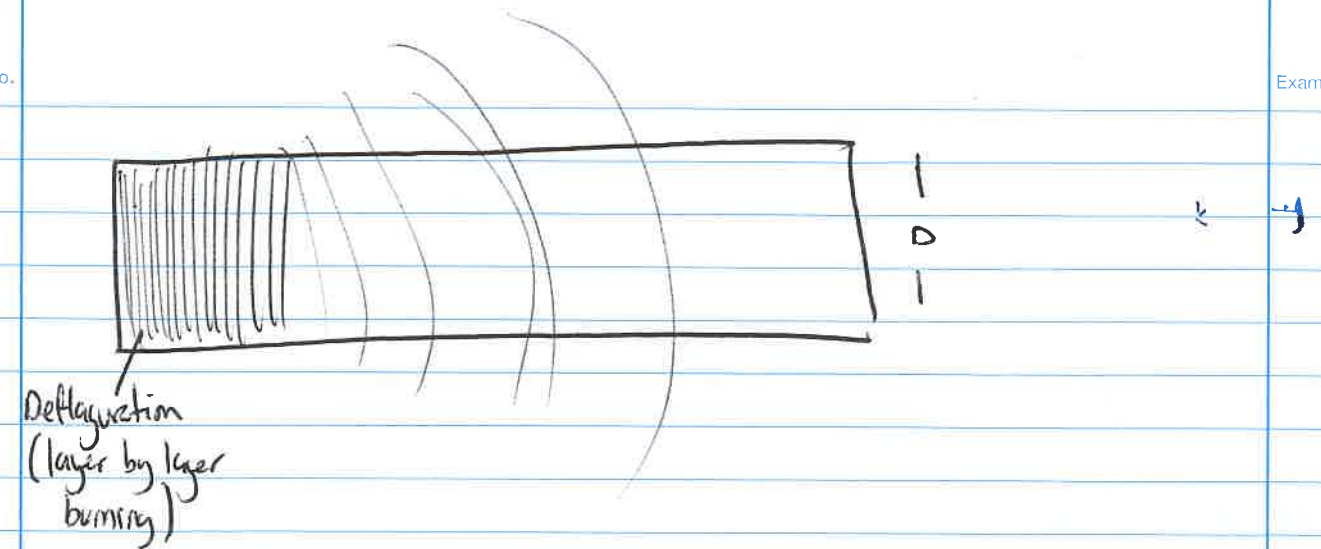
1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners cannot read illegible script or have it typed and the expense of typing is 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	2318704
2	Title of Examination Paper	PRINCIPLES OF GME
3	Module Code	ACDA 4019
4	Date and Time of Examination	08/01/25 1200
5	Examination Venue	Room 310
6	Seat Number	032
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	4
2	7
3	9
4	6
5	6
6	5/6
7	4
8	5
9	1/2
10	1/2
Total	49

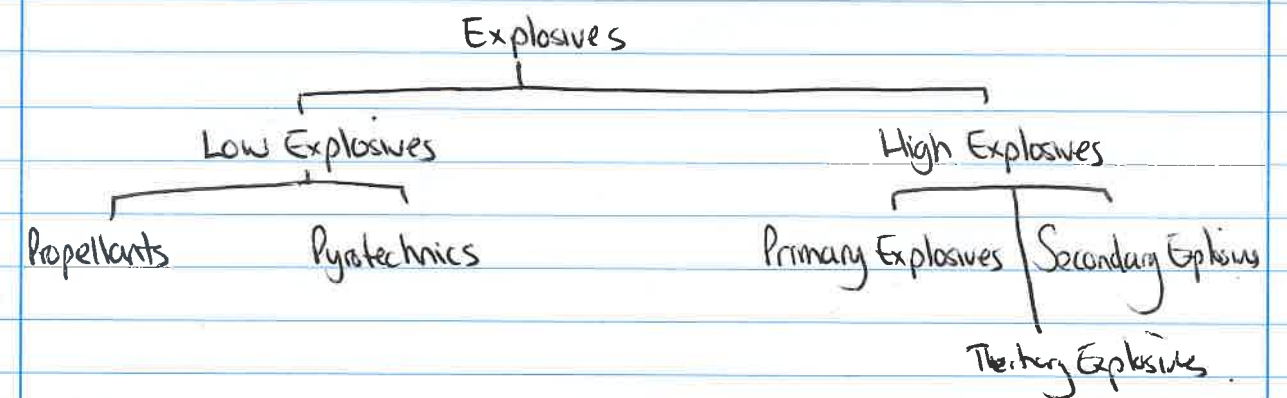
(Gweler yr ochr arall am y fersiwn Cymraeg)

1a.



If the deflagration of a material increases where the wave surpasses sub-sonic speeds and into super-sonic, then a detonation wave can propagate. If the charge's diameter is increased so is detonation velocity.

2a.



b. Primary Explosives are highly sensitive to stimuli, used to initiate an explosive train, such as Lead Azide and Mercury Fulminate.

Secondary Explosives are not sensitive and require significant stimuli to initiate
ie. RDX, HMX,

Propellants are used to provide thrust in rocket motors, normally double- or triple based.

Pyrotechnics burn and produce smoke or heat dependant on its application ie. Counter measures (Flare)

c. Insufficient energy provided by the detonator to produce the required activation energy, a booster was required.

3a. Critical diameter is the minimum diameter of an explosive charge, where a self-sustaining detonation can propagate

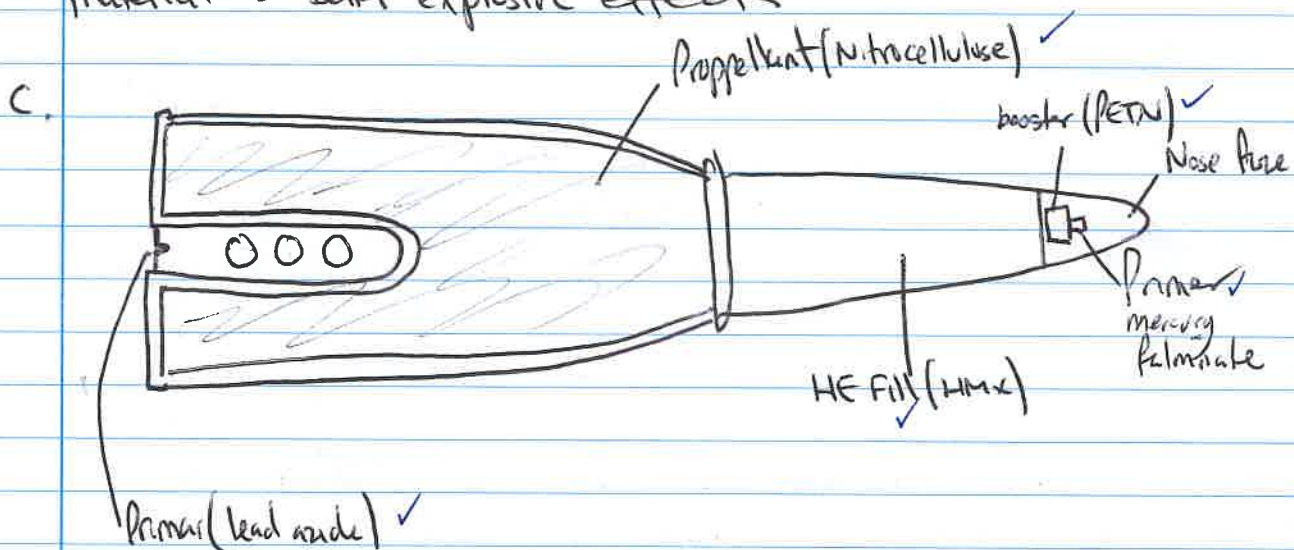
1

Critical Density is the minimum density of an explosive material for ~~propagation~~ self-sustaining detonation to propagate

1

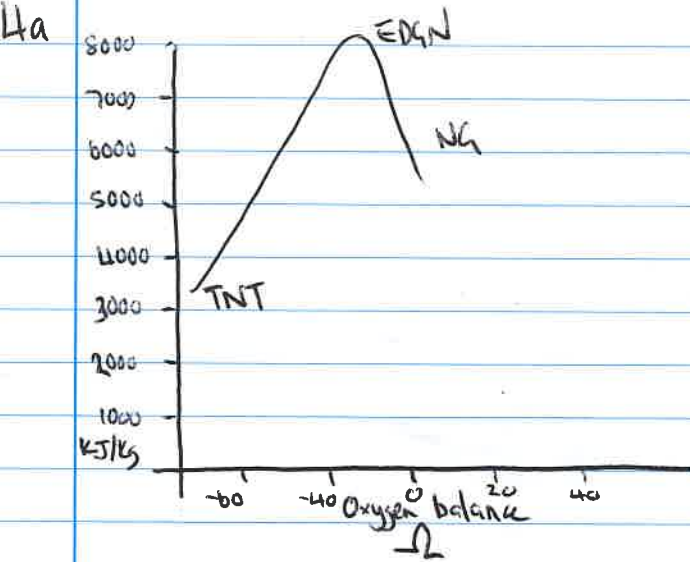
b. Knowing the critical diameter is crucial in the designing of an explosive charge. If below, detonation will not propagate. Critical density needs to be factored in design to ensure propagation and desired result. i.e. the denser a material = better explosive effect

2



5

9



2

4b. TNT ~~is~~ has a negative oxygen balance, therefore all products are not consumed, resulting in carbon etc being released.

1

c. Carbon monoxide
Carbon
Nitric oxides.

1

d. Adding aluminium to an explosive increases the heat of the explosion (Q) and volume of gases. Aluminium acts as added fuel as is exothermic.

2

6

5a. A hotspot in a primary explosive is caused by inter-crystalline friction or adiabatic heating, if sufficient energy is produced to reach the activation energy of the energetic material then deflagration/detonation can occur.

A hotspot in a secondary explosive is caused by adiabatic compression of the small gas pockets between the crystals, again if the energy ~~propagation~~ is sufficient to reach the activation/ignition temp. Then deflagration/detonation can occur.

4

b. Diurnal cycling of TNT can cause crack (micro) to occur as the material undergoes thermal expansion and contraction. TNT is susceptible to the crystalline structure aligning during curing and heating, resulting a more sensitive material.

2

6

6a. Single base = Nitrocellulose (Small Arms)
Double base = Nitrocellulose + Nitroglycerin (Artillery, Rockets)
Triple base = Nitrocellulose + Nitroglycerin + Nitroguanidine.
(advanced missile systems).

1
1
1/2

b. 12% $\Delta N = \Delta$ Force Constant + Flame Temperature

0 1/2

c. RDX could be added to a double base propellant to increase the force constant and flame temp. Doing so, can increase wear on the barrel and would require additives to mitigate (anti-wear, cooling etc.).

3

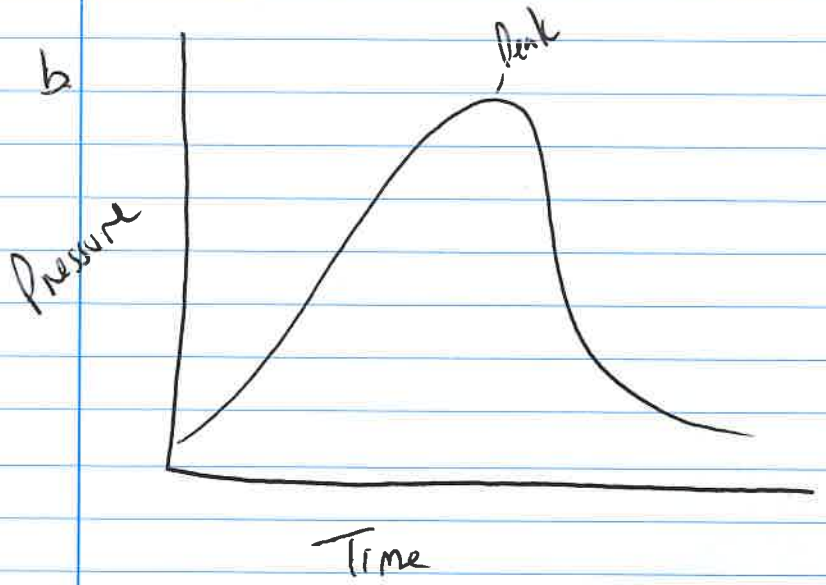
d. Additives to the propellant, such as anti-wear and cooling additives

0
5/6

7a. Fuel Air Explosive Device

Once on target, the fuel will be dispersed into the air, making an oxygen + fuel rich environment, at which point an igniter would detonate, propagating to a booster, producing sufficient energy to ignite the fuel/Air environment.

4



0

4

8a. both projectiles have the same mass and are travelling at the same velocity. The projectile with the least surface area contacting the arrow will penetrate more due to greater force energy (kinetic) being concentrated into a smaller area.

a. If both projectiles have the same mass but Projectile B is smaller in diameter, this means the material is more dense than Projectile A. Thus, having more kinetic penetration and less energy being lost in trying to displace the target material.

3

b. The sabot would achieve the greatest penetration due to it being more streamline, thus reducing drag and provided more kinetic energy to a smaller surface area.

2

9a. Gassy delay = tube full of explosive gases (flash tube) and quick Gassy = slow burn for time

1/2

b. Quick or delayed initiation

0

c. Conductivity is required to ensure heat/energy transfer is ideal, porosity in the material can interrupt that transfer

1
1 1/2

10a. That they burn and release photons at differing wavelengths.

1/2

b. To be able to detect infrared seeking guidance systems that have the ability to differentiate between targets.

0
1 1/2



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Complete, fold and seal
(see note 2 below)

SURNAME: Critchley

FORENAME(S): William

Examination Answer Books

12 Pages

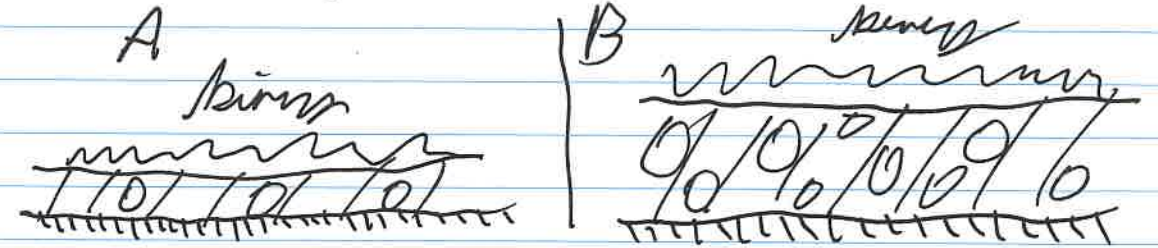
Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can only read what is written. If you cannot write, you may dictate 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	2309517
2	Title of Examination Paper	Principles of OME
3	Module Code	ACDA 4019
4	Date and Time of Examination	08/01/2024 12:00
5	Examination Venue	IQ 310
6	Seat Number	31
7	Number of Answer Books handed in	

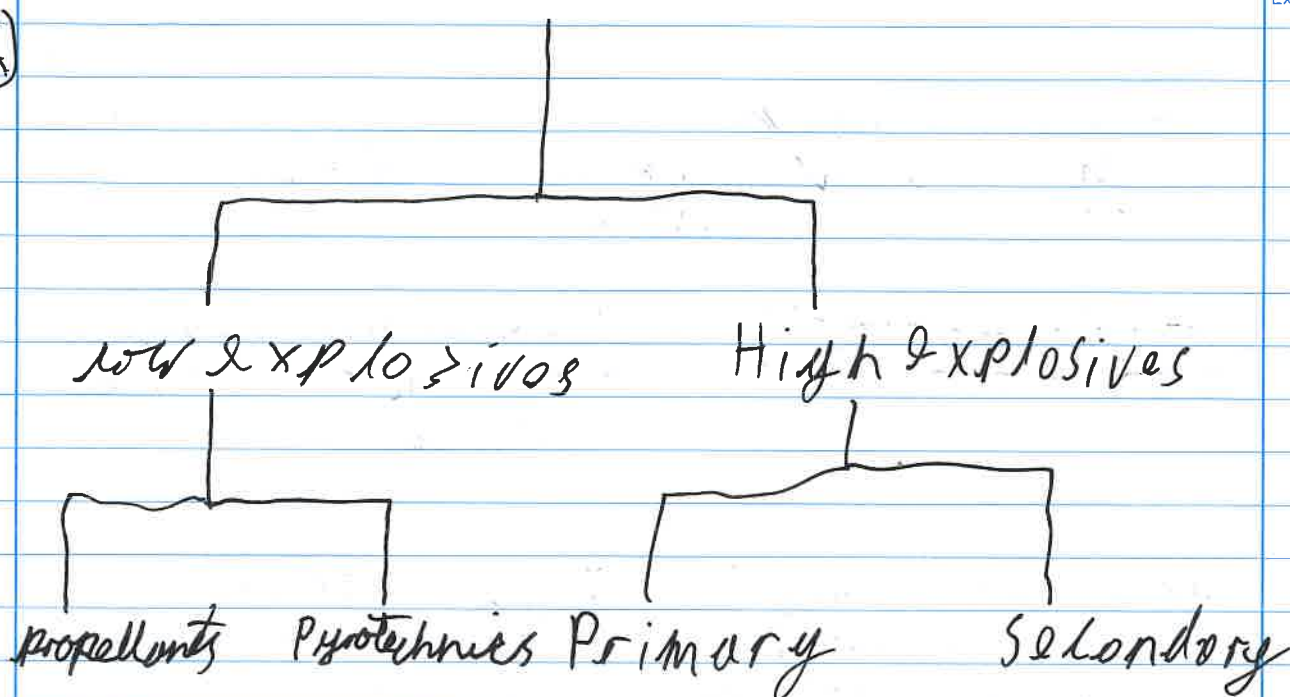
List the numbers of the questions you have attempted	Office Use
1	2
2	8
3	8
4	7
5	5
6	5
7	6
8	5
9	6
10	0
Total	52

1) A) is explosive but not so fast as the explosion
is thick enough to ^{~ critical diameter}



in B but only will form more explosive than in A. These hot spots are what allow the explosion to detonate. This was demonstrated in B event where ammonium nitrate ^{real-life example} was burnt to detonation. This phenomenon can also occur. This was also happen when the reaction of the degradation one went fast to where the ^{slow} thick layer was where they overtake the burn front in an explosion

2) A)



B) Low explosives deflagrate while high explosives detonate. Propellant ~~low~~ deflagrates releasing large amounts of gas to propel a munition e.g. nitrocellulose and nitroglycerine. Pyrotechnics deflagrate to produce EM radiation (heat and light) and smoke e.g. magnesium and MTV. Primary explosives are very sensitive but provide a boost to set off the sensitive secondary explosives e.g. mercury fulminate and lead azide. Secondary explosives are less sensitive but more powerful used for main fills e.g. RDX and TNT.

C) Due to ANFO's relative insensitivity a commercial detonator would not be powerful enough to transfer the detonation wave to the explosive. A secondary explosive e.g. RDX would be needed to provide the boost.

R4

5

2

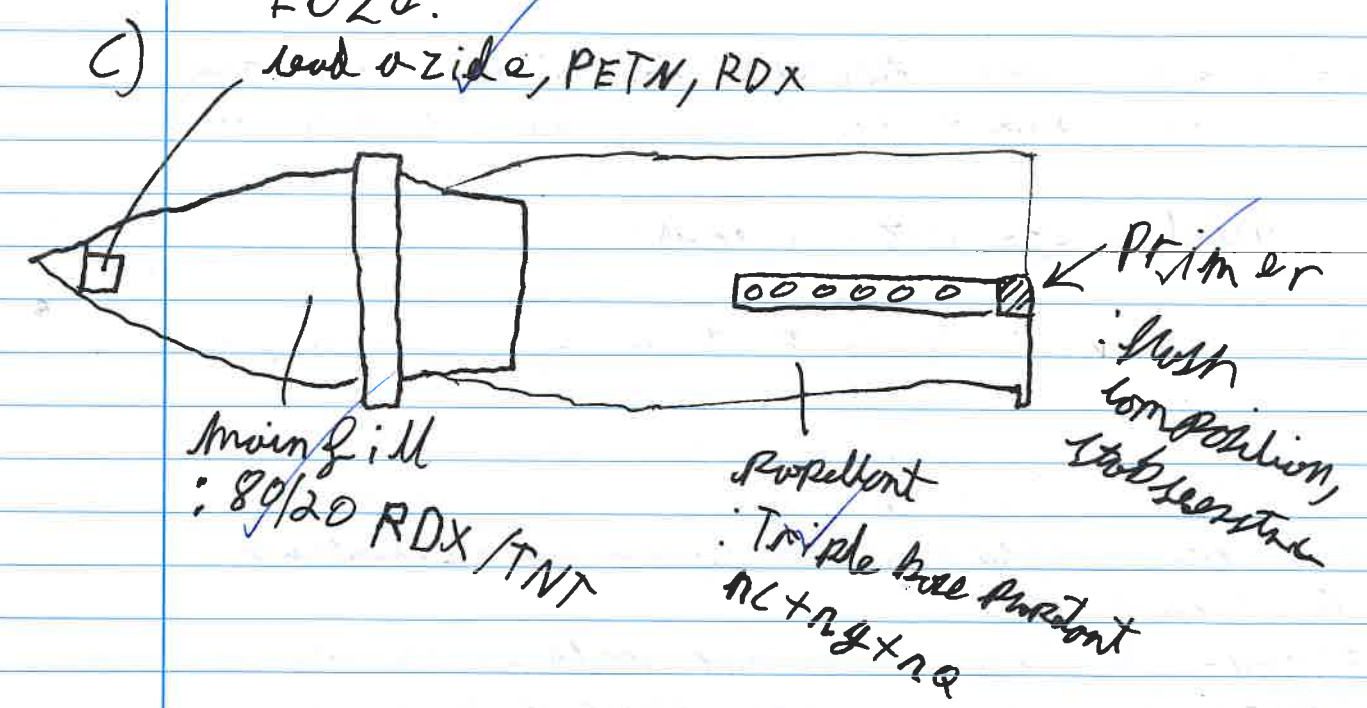
3)

A) Critical diameter - the minimum diameter of a tube filled with explosive needs to be to sustain a detonation wave.

Critical density - the minimum density for an explosive of a given volume needed to sustain a detonation wave.

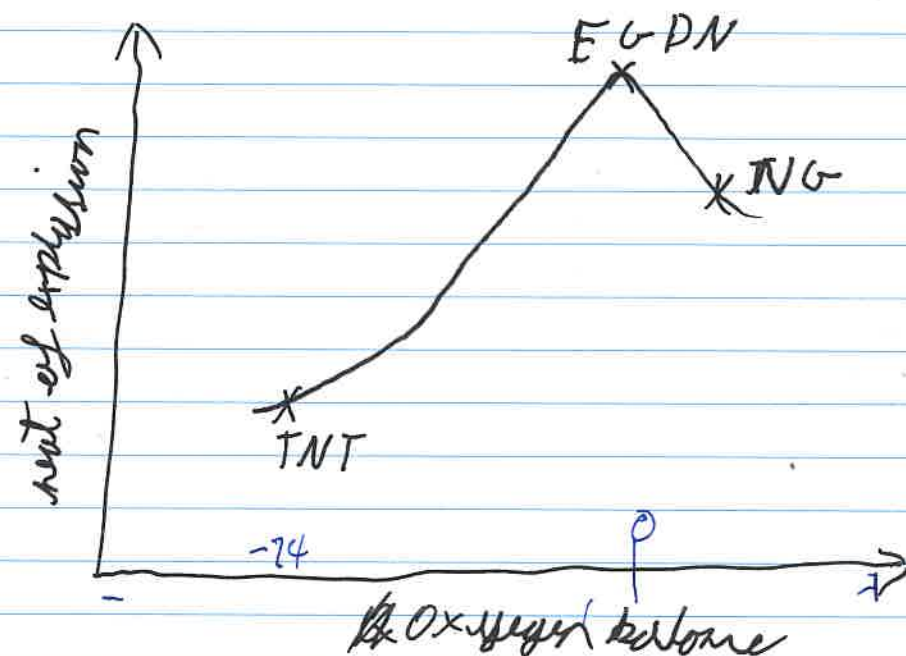
B) they are critical as they tell you the minimum diameter and fill density required for the munition to have the desired effect.

FUZO: lead azide, PETN, RDX



4

4) A)



B) due to its highly negative oxygen balance a lot of the reading we got would have been carbon giving the black colour

C) I would expect to find:



D) if aluminium was added to an explosive the heat of detonation would be increased though the volume of gas would be slightly decreased as explosive was removed to make space for the Al.

5)

A) a hot spot is a place of internal tension ^{sort of!} inside an explosive there are many tiny inclusions ~~they~~ irregular and thermal ~~long~~ these are what they long ~~they~~ long when hitting TNT for example and then heated and heated ~~running~~ up in a bundle with a large internal ~~hole~~ hole. ignition temperature is the temperature on exposure ~~needs~~ to reach to spontaneously ignite eg C4's is 250°C .

when hot spots develop it can cause a detonation

B) due to TNT's low melting point, 80°C , it would be more than enough for it to flow along cracks to form a ~~and~~ ~~reform~~ ~~very~~ hot, if hot spots so when the shell ~~indiment~~ ~~10000g~~ + of setback they ~~break~~ ~~causing~~ a detonation

6)

A) single NC	double NC + NG	triple NC + NG + NQ
small arms and mortars	High energy small arms	artillery & missile charges

B)

C) a high explosive like RDX could be added this would negatively affect barrel life due to the extreme pressure from firing.

D) the use of additives to the propellant such as a de-coppering agent to clean rifling

3

2

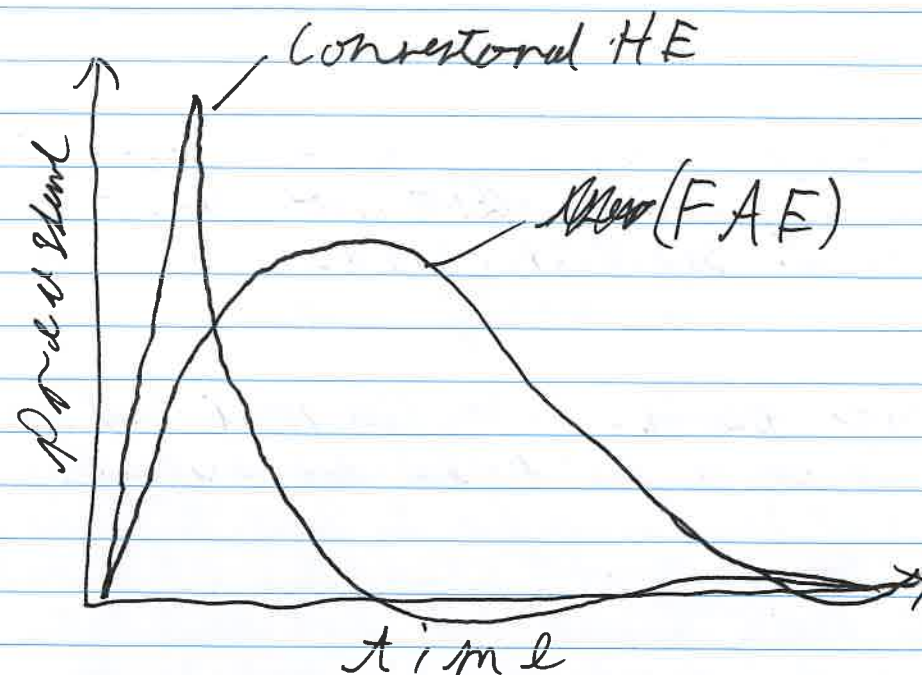
5

7)

A) Fuel air explosives work by using 2 independent fuses one is impact operated which detonates & bursting Hoof dispersing fuel into the air. then a second fuse either a dropout or a delayed drop ignites the vaporised fuel causing an explosion.

FAE's have the disadvantage of a lower peak pressure than conventional explosives but have a much higher impulse which is a "more" effect that is effective against structures, infantry and entrenched positions.

B)



3

1

2

6

$$\pi \approx 3.14$$

Question No.

8)

A) Projectile B will penetrate more. ✓

This is due to the amount of pressure being exerted.

$A \quad \begin{array}{l} 20\pi = 62.8 \\ 10\pi = 31.4 \\ 4\pi = 12.56 \end{array}$ $\pi 2^2 \approx 12.56 \text{ mm}^2$	}	$B \quad \begin{array}{l} \pi 4 \\ \approx 12.56 \text{ mm}^2 \end{array}$
--	---	--

A's impact area is nearly 7x as big as B's
 as the force is equal due to equal mass and velocity, B's force will be 7x higher
 also B will have a higher density. ✓

B) I believe that the APFSDS round will penetrate more armor than the APCBC round.

i think this because on the fin round most of the mass is in a line behind the penetrator tip meaning all of this mass can be used to drive the round into the target. whereas the APCBC round has large ^{portion} ~~portion~~ that don't assist in the penetration of the target. the fin round is also thinner leading to higher pressure on the armor

Examiner Only

Question No.

9)

A) or if possible delay has been changed to not produce gas when burning when a delay has.

B) why - poorer burning pressure once parachute slows motion round
 why less - when in close proximity to hostile electronics that could be effected

C) conducting is how well a body sort con transfer through a substance when passing is how strong magnetic field a compass has when held near it etc. when passing through it becomes more difficult for the flame front to propagate so a better burner the conducting and burn rate must be found

Rhif y Cwestiwn

5

Arholwr yn unig

Examiner Only

Rhif y Cwestiwn

6

10)

A) the blue part ~~of the~~ with a lot more energy than the red. but the red has more packets at different wave lengths. The blue is also much more efficient being almost all in blue wave length while red being a lot in yellow

B) of different computers burn at different rates, formats and programs how can we burn must be carefully controlled as to provide a consistent effect for the user when using different products as red and blue flame burn for the same length of time