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Houston Fire Department — HFD Investigator 1/7/2015

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Detonation- supersonic velocities, more than 1100 feet per second; CANT be vented
Deflagration- Subsonic velocities, can be successfully vented pg [279]
The major difference is Speed of Pressure rise. The rate and rise of pressure is what seperates the two. One can be vented and one can Not be vented. Venting is dependent on the SPEED of pressure rise. Timing has no relation to venting. Pressure and Speed do. Time in the chapter is related to how long it takes a flame to heat a container, depending on flame distance and location. It is the speed of pressure rise that differentiates ~~the~~ ~~two~~ between detonation and deflagration.
Page [279] Investigator 921 and 1033 states that the difference between detonation vs deflagration is Pressure vs Time. ~~Both~~ Both of those answers to qcestion 33 is Confusing

The most appropriate answer would have been speed. As listed above, what causes a detonation as opposed to deflagration is the rapid pressure rise that can Not be vented due to its Speed. Higher pressure equates to more damage, which is detonation. lower pressure rise equates to lower damage ~~which~~ is detonation.
Overall, B+C should [BOTH] be accepted. Had speed been an answer choice, it would have been the Clear Choice and BEST answer

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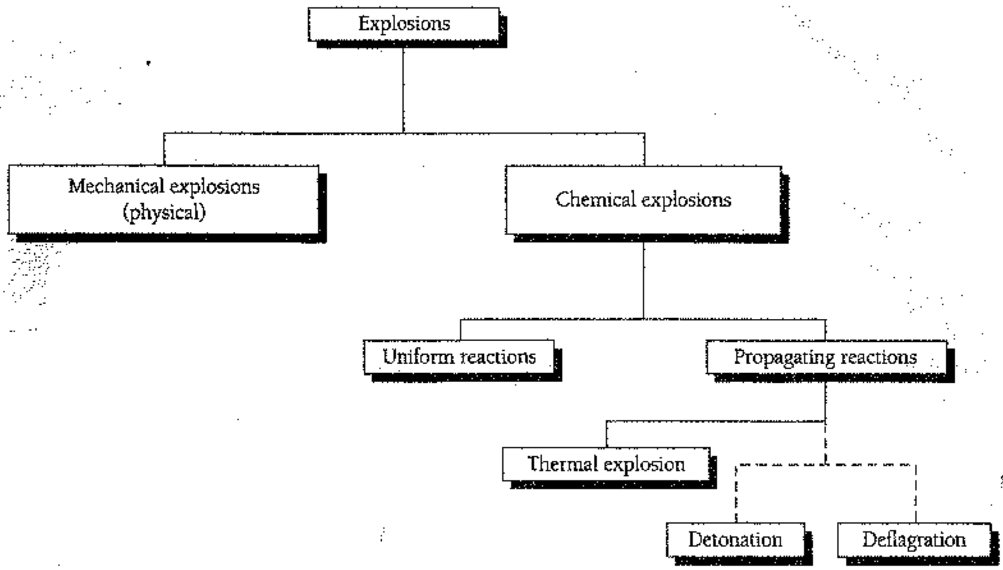

Figure 19-1 Types of explosions.

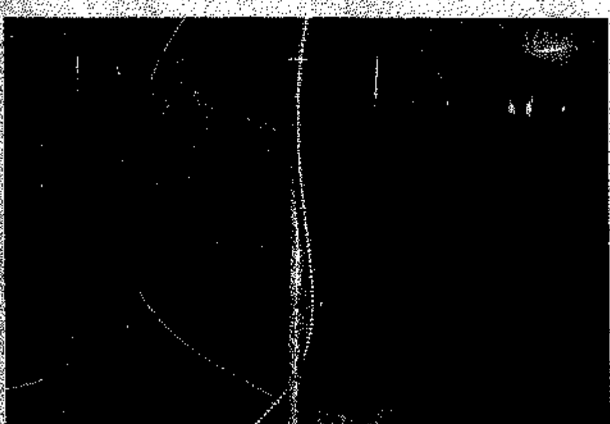

Figure 19-2 BLEVE damage.

vapor usually occurs from the original heat that caused the BLEVE or from another electrical or mechanical source. A common example of a BLEVE that does not involve an ignitible liquid is the rupture of a steam boiler. The energy source is the pressurized steam. Additionally, a BLEVE may result from overfilling, runaway reaction, vapor explosion, or mechanical failure.

Chemical Explosions

Chemical explosions are those in which a chemical reaction is the source of the high-pressure gas and the fundamental chemical nature of the fuel is changed. Although chemical explosions can involve solid combustibles or explosive mixtures of fuel and an oxidizer, most typical are the propagating reactions that involve gases, vapors, or dust mixed with air.

Combustible Explosions

The most common chemical explosions are those caused by the burning of combustible hydrocarbon fuels. A combustion explosion is characterized by the presence of a fuel (such as dust) with air as an oxidizer. The elevated pressures are created by the rapid burning of the fuel and the rapid production of combustion byproducts and gases. The velocity of the flame front propagation through the fuel determines whether the combustion reaction is classified as a deflagration (less than the speed of sound) or detonation (faster than the speed of sound).

Uniform reactions occur more or less equally throughout the material and include ordinary chemical reactions that form gaseous products at a rate faster than they can be vented. Propagating reactions initiate at a specific point in the material and propagate as a reaction front through the unreacted material.

Thermal explosions are the result of exothermic reactions occurring within confinement without provisions for dissipating the heat of reactions. This can accelerate to the point at which high-pressure gases are generated and an explosion occurs.

A deflagration is a reaction that travels through the air (propagates) at subsonic velocities, several feet per second. A deflagration can be vented successfully. A detonation is a reaction that propagates at supersonic velocities, more than 1100 feet per second (335 meters per second).

The difference between a detonation and a deflagration is the magnitude as to pressure versus time for the system involved in the combustion reaction. A significant difference between deflagration and detonation is time; the detonation is faster and cannot be vented because of the speed of the reaction.

Subtypes of combustion explosions are classified as flammable gases, vapors of ignitible (flammable and combustible) liquids, combustible dusts, smoke and flammable products of incomplete combustion (such as in a backdraft explosion), and aerosols.

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Deflagration detonation

In NFPA pg 279

The difference between a detonation and deflagration is the magnitude as to pressure versus time for the system involved in the combustion reaction

So actually both time and pressure

Also under the effects of explosions in pg. 289 also NFPA
At a distance from a detonation explosion center, the pressure rise is moderate, and the ~~ate~~ artifacts resemble those of a deflagation explosion

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of overpressure such as displacement or bulging of walls, floors, ceilings, doors and windows, roofs, structural members, nails, screws, utility service lines, panels, and boxes. Also analyze the extent of heat damage to the structure and its components to determine whether the damage can be attributed to fire alone.

Determining High- or Low-Order Damage

The investigator should determine whether the damage indicates high-order or low-order damage. Review Section 21.3 of NFPA 921 to assist in the classification of the type, quantity, and mixture of the fuel involved.

Identifying Seated or Nonseated Explosion

The investigator should determine whether the explosion was seated or nonseated. Review Section 21.6 of NFPA 921, which will assist in classifying of the possible fuel involved.

Identifying the Type of Explosion

Identify the type of explosion involved: mechanical, chemical, other chemical reaction, or BLEVE.

Identifying Potential General Fuel Type

Identify the types of fuel that were potentially available at the explosion scene by identifying the condition and location of utility services (fuel gases) and sources of ignitible dusts or liquids. Analyze the nature of the damage in comparison to the damage patterns consistent with the following: lighter-than-air gases, heavier-than-air gases, liquid vapors, dust, explosives, backdrafts, and BLEVEs.

Establishing the Origin

Attempt to establish the origin of the explosion as soon as possible. The origin is usually identified as the area of most damage—a crater or localized area of severe damage in the case of a seated explosion. If it is a diffused fuel–air explosion, the origin is consistent with the confining volume or room of origin.

Establishing the Fuel Source and Explosion Type

Identification of the fuel source begins by determining the types of fuel that were available at the site through locating and then inspecting utility services (especially fuel gas), production byproducts such as dusts or particles, and any ignitible liquids present for any reason. Damage at the scene is compared with typical damage patterns of lighter-than-air gases, heavier-than-air gases, liquid vapors, dusts, explosives, backdrafts, and BLEVEs.

Establishing the Ignition Source

Attempt to identify the ignition source by looking for potential sources, including hot surfaces, electrical arcing, static electricity, open flames, sparks, and chemicals in which fuel–air mixtures are involved. If explosives are involved, the ignition source may be a blasting cap or pyrotechnic device. Be sure to note artifacts from the ignition sources that may have survived the explosion.

Detailed Scene Assessment

After obtaining the general information from the initial scene assessment, a more detailed study of the blast damage is recommended using the tasks that are listed later here (the investigator should record all findings).

Effects of Explosion

A detailed analysis of the explosion overpressure damage should be made. The articles that are damaged should be identified as having been affected by one or more of the following forces: blast pressure wave–positive phase, blast pressure wave–negative phase, shrapnel impact, thermal energy, and seismic energy.

The investigator should examine the type of damage as to whether the debris was shattered, bent, broken, or flattened as well as a change in the pattern. At a distance from a detonation explosion center, the pressure rise is moderate, and the artifacts resemble those of a deflagration explosion. Items in the immediate vicinity of the detonation center exhibit splintering and shattering.

The scene should be examined carefully to identify any fragments of foreign material. Estimation of damage from an explosion includes the maximum pressure of the explosion compared with the construction of the structure. A light-framed structure can be damaged with much less overpressure than a reinforced structure, for example.

Review Tables 21.13.4.1.4(a) and 21.13.4.1.4(b) in NFPA 921 to assist in estimating the peak blast overpressure from the structural damage.

Damage to personnel from explosion blast pressures is usually a result of acceleration in the high-velocity air steam with subsequent impact against a rigid surface, rather than compression in the airwave itself. More information on blast injuries can be found in Chapter 21, Fire and Explosion Deaths and Injuries, in this textbook. Some threshold values for physiological effects are shown in Table 21.13.4.1.4(a) from NFPA 921.

Preblast and Postblast Damage

Debris that has been burned and propelled away from the point of origin may indicate that a fire preceded the explosion. Glass fragments with smoke residue and soot found some distance from the structure may indicate a fire of some duration followed by an explosion. Glass fragments that are clean and debris that is not burned but found some distance from the structure may indicate an explosion prior to the fire.

Articles of Evidence

The method used document scene artifacts may include locating, identifying, noting, logging, photographing, and mapping of physical evidence.

The probability of physical evidence being propelled both inside and outside of the structure may result in the evidence being found imbedded in walls, resting in adjacent vegetation, inside adjacent structures, and within the body and clothing of victims. Photographs must be taken of the injuries to the victims as well as any materials removed from them during medical treatment. Hardhats, gloves, boots, and respirators as well as clothing and materials removed from the victims should be preserved for further examination.

The condition and position of damaged structural components—walls, ceilings, floors, roofs, foundations, support columns, doors, windows, sidewalks, driveways, and patios—should be noted. The condition and position of buildings contents such as furnishings, appliances, heating or cooking equipment, manufacturing equipment, clothing, and personal effects should also be noted.

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~~The~~ Answer (B) is correct word per word " " the explanation after states "the detonation is faster and cannot be vented b/c of the speed of the reaction.
That states "time" didn't allow to vent, which creates pressure.
It might not be "a significant difference between deflagration and detonation" but is "the difference between a detonation and deflagration is magnitude as to pressure versus time for the system involved in the combustion reaction."
- Answer (C) is correct also. Might not be "significant" but its a difference that has to do w/ time if you understand it

deflagration can be vented successfully due to not enough pressure
detonation creates so much pressure that it can't be vented.

pg 279, Column 2, paragh 4 ; 5

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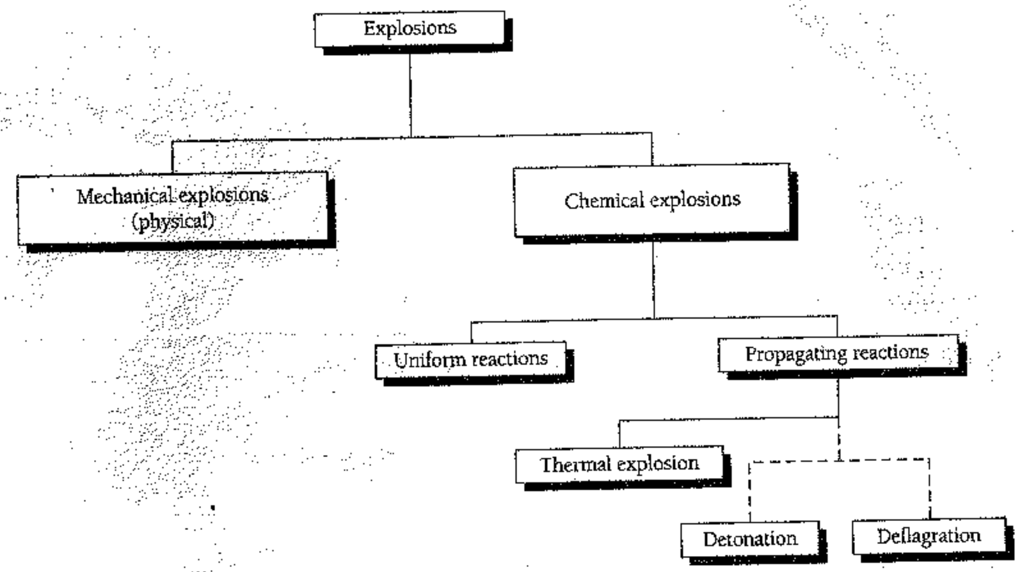

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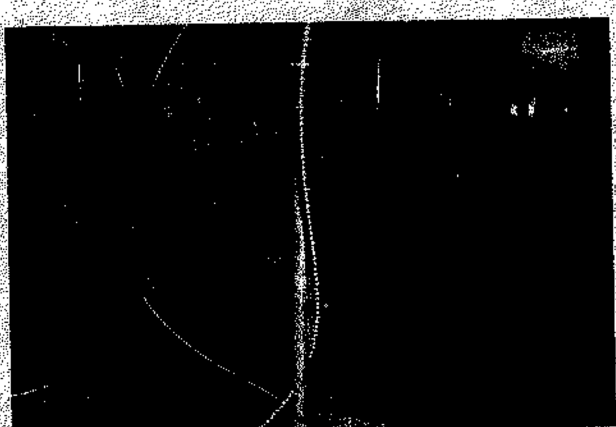

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The blast pressure front is moving at a speed.
Deflagration is moving the pressure front less than the speed of sound.
Detonation is moving the pressure front greater than the speed of sound.
This question should get dual credit.
Thanks.

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