Continuing Education Course #199
Forensic Analysis
Involving Fugitive Natural Gas and Propane

1. A fugitive fuel gas
- a. is incapable of ignition
- b. will always lead to an explosion
- c. will always lead to a fire
- d. will always move away from its point of release

2. The flammable range of a fuel gas consists of
- a. only those gas concentration levels capable of maximum explosive force
- b. the range of temperatures over which the fuel gas is ignitable
- c. all the gas concentration levels capable of ignition
- d. the range of gas concentrations that do not result in smoke after ignition

3. The wider the flammable range of a gas
- a. the more readily an ignitable mixture of the gas in air will be able to form
- b. the greater will be the energy released upon ignition of the gas in air mixture
- c. the greater will be the explosive damage when the gas-air mixture is ignited
- d. the greater will be the pressure released when the gas-air mixture is ignited

4. When a gas-air mixture above the Upper Flammable Limit is in contact with a competent ignition source
- a. an explosive will result
- b. a fire will result
- c. ignition will not occur
- d. a smoke cloud will develop

5. Following the ignition of a stoichiometric mixture of gas in air, the gaseous products of combustion
- a. will reach the maximum explosive pressure for that set of products
- b. will reach the maximum temperature for that set of products
- c. will contain no excess fuel and no excess oxygen
- d. all of the above

6. The flammable range of natural gas is
- a. 5% to 9.6%
- b. 2.1% to 15%
- c. 5% to 15%
- d. 2.1% to 9.6%

7. The flammable range of propane vapor is
- a. 5% to 9.6%
- b. 2.1% to 15%

○ c. 5% to 15%
○ d. 2.1% to 9.6%

8. Graham's Law deals with
○ a. the mixing of gases
○ b. the flammability of gases
○ c. the heat of combustion of gases
○ d. none of the above

9. When a mixture of two gases is isolated in a container, the gas with the larger molecular weight will eventually settle to the bottom of the container, and the gas with the smaller molecular weight will rise to the top.
○ a. True
○ b. False
○ c. It depends upon whether the specific gravity of the mixture is higher or lower than the specific gravity of air
○ d. It depends upon the temperature of the mixture of gases.

10. The specific gravity of a mixture of two gases is
○ a. equal to the specific gravity of the heavier component of the mixture
○ b. equal to the specific gravity of the lighter component of the mixture
○ c. the weighted average of the heat of combustion of the constituents of the mixture
○ d. the weighted average of the specific gravities of the constituents of the mixture

11. The strongest mechanism for mixing a fugitive gas with air is
○ a. convection
○ b. dispersion
○ c. diffusion
○ d. dilution

12. A house having a floor area of 2,000 square feet, a ceiling height of 8 feet and an hourly air exchange rate of 0.5 ACH will have in air infiltration rate of
○ a. 1,000 ft^3/hr
○ b. 8,000 ft^3/hr
○ c. 16,000 ft^3/hr
○ d. 32,000 ft^3/hr

13. Confining the explosive ignition of a fuel gas will
○ a. muffle the sound of the explosion
○ b. reduce the pressure of the resulting products of combustion
○ c. raise the pressure of the resulting products of combustion
○ d. result in pressures lower than those encountered in an unconfined explosion

14. Fugitive propane vapor inside a structure will always flow to lower levels.
○ a. True
○ b. False
○ c. Depends upon the air movement within the structure
○ d. Depends upon the amount of confinement provided by the structure

15. A flow of natural gas released at floor level into a room will
○ a. mix with the surrounding air as it rises from the floor level
○ b. create a layer of 100% natural gas at ceiling level

○ c. create an explosive mixture throughout the room at the onset of the gas release
○ d. create an explosive mixture at the ceiling only

16. The perfect mixing equation assumes
○ a. no pressure gradients are present in the mixture of gases
○ b. no temperature gradients are present in the mixture of gases
○ c. the specific gravity of the mixture is everywhere the same
○ d. all of the above

17. The parameters used in the perfect mixing equation are
○ a. gas concentration, specific gravity of the mixture, air flow rate, gas flow rate and time
○ b. gas concentration, volume of the mixture, air flow rate, gas flow rate and time
○ c. gas concentration, specific gravity of the mixture, the hourly air exchange rate and time
○ d. volume of the mixture, the hourly air exchange rate, the gas flow rate and time

18. The flow rate of natural gas into a room is 11 cubic feet per hour. The flow rate of air into the same room is 100 cubic feet per hour. Assuming perfect mixing in the room, what is the steady state concentration of the natural gas in the mixture, to the nearest percent?
○ a. 9%
○ b. 10%
○ c. 11%
○ d. 12%

19. Assuming perfect mixing in a room with a natural gas leak, the higher the gas flow rate in
○ a. the shorter will be the time to reach flammable levels in the mixture
○ b. the lower will be the steady state concentration
○ c. the higher will be the specific gravity of the steady state mixture
○ d. all of the above

20. Any natural gas leak inside a house, no matter how small, will eventually reach a concentration capable of explosive ignition
○ a. given a long enough time to accumulate gas to an explosive level.
○ b. because the confinement provided by the house prevents any loss of the accumulating gas
○ c. when the steady state concentration is reached
○ d. none of the above

21. When a building's structural damage is such that the house is described as being "uninhabitable," the minimum explosive overpressure experienced by the house is most likely
○ a. 1.0 psig
○ b. 2.0 psig
○ c. 2.5 psig
○ d. 3.0 psig

22. A fugitive gas inside a house leads to an explosion and fire. The house is heavily burned inside. The doors and some of the window frames are found unburned on the ground just outside the house. The gas concentration at the point of ignition was most likely
○ a. above the Upper Flammable Limit
○ b. between the Stoichiometric Level and the Upper Flammable Limit
○ c. at the Stoichiometric Level
○ d. between the Lower Flammable Limit and the Stoichiometric Level

23. A fugitive gas inside a one-story house leads to an explosion. The exterior walls are found to bulged outward at the bottom of each wall, having been separated from the sill plate by the force of the explosion. None of the house's structural components show fire damage. The gas concentration at the point of ignition was most likely

- a. above the Upper Flammable Limit
- b. between the Stoichiometric Level and the Upper Flammable Limit
- c. at the Stoichiometric Level
- d. between the Lower Flammable Limit and the Stoichiometric Level

24. A fugitive gas inside a one-story house leads to an explosion. The exterior walls are found to bulged outward at the top of each wall, having been separated from the roof trusses by the force of the explosion. None of the house's structural components show fire damage. The gas concentration at the point of ignition was most likely

- a. above the Upper Flammable Limit
- b. between the Stoichiometric Level and the Upper Flammable Limit
- c. at the Stoichiometric Level
- d. between the Lower Flammable Limit and the Stoichiometric Level

25. A fugitive gas inside a building leads to an explosion. The structure is completely demolished with components found in trees and on the ground at great distances from the building's location. No evidence of burning or charring is to be found on any of the debris or within the remains of the foundation. The gas concentration at the point of ignition was most likely

- a. above the Upper Flammable Limit
- b. between the Stoichiometric Level and the Upper Flammable Limit
- c. at the Stoichiometric Level
- d. between the Lower Flammable Limit and the Stoichiometric Level