



Answer the following questions. Assume any necessary assumptions. Use of gas tables is allowed.

1- Choose the correct answer. (10 marks)(a1, a8,b7)

- 1- Which substance gives heat and light after combustion?
a. Flame b. fuel c. combustion d. None of these
- 2- CNG and LPG are the examples of.
a. Solid fuels b. Liquid fuels c. Gaseous fuels d. They are not fuels
- 3- High excess air in combustion of fuels results in
a. incomplete combustion b. smoky flame c. increased fuel consumption d. none of these
- 4- The lowest temperature at which a fuel will ignite in the presence of an ignition source is called its-
a. Boiling point b. Flash point c. auto-ignition temperature d. Critical temperature
- 5- What is the percentage of excess air, if 10 moles of air entered the process and only 8 moles of that are
a. 25%. b. 50%. c. 75%. d. 100%.
- 6- A mixture of gases CO_2 , O_2 and 4 g of N_2 and total mass of mixture is 10 g, what is the sum of mole fraction of CO_2 and O_2 ?
a. 0.25 b. 0.6 c. 0.75 d. 1.
- 7- How many kg of air are used to combust 55.5 L of gasoline C_8H_{18} ?
a. 610 b. 615 c. 620 d. 625
- 8- Which is the hottest part in the flame
a. white b. yellow. C. black. d. blue.
- 9- Gasoline and air are both present in your automobile fuel tank, but combustion process does not occur because.
a. Temperature is at atmospheric b. Air-fuel ratio is not balance
c. There's no heat source d. its flash point is high
- 10- In case of pulverized coal fired steam boiler, the secondary air serves the main purpose of.
a. Transportation of coal b. drying of coal c. preheating the primary air.
I. d. Combustion of coal by supplying it around the burner

2 (10 marks)(a8,c1)

- a) Discuss the different factors that affect on the choice of fuel.
- b) Why use diesel directly in compression ignition engines.
- c) Why the flame is quenched? What is quenching diameter?
- e) Why Paper by itself catches fire easily whereas a piece of paper rapped around an aluminium pipe does not?

3-a) Mention the types of Elementary reactions with write equations? Explain the relationship between the reaction rate and temperature, pressure and Equivalence ratio? (10 marks) (c1)

3-b) "IF IT'S MIXED, IT'S BURNT" Discuss these words on basis of time of ignition and turbulent flame. (10marks)(b11,a8,b5)

3- c) Discuss the method of Ignition of a combustible material? What is the Minimum ignition energy? Mention the effect of temperature, pressure and Equivalence ratio on it? (10 marks)(b11,c7)

4- Fuel is assumed to have a chemical composition of $C_{8.26}H_{15.5}$.

(a) Determine the mole fractions of CO_2 and O_2 in the exhaust for an engine with normalized air/fuel ratio $\lambda=1.2$.

(b) The enthalpy of formation of $C_{8.26}H_{15.5}$ is -250 MJ/kmol. Determine the LHV of fuel in terms of MJ/kg. The molecular mass of $C_{8.26}H_{15.5}$ is 114.62 kg/kmol. if the products are at 500 K. Take $h_{fg}=2400$ kJ/kg. (15 marks)(b7,c7)

5- Gasoline C_8H_{18} is burning in atmospheric air. The flue gases have recorded the following data: 10.02% CO_2 , 0.88% CO , 5.62% O_2 , and 83.48% N_2 . Determine Equivalence Ratio and % of excess air. (10 marks)(a8,c7)

Good luck,

Dr. M. K. El-Fakharany
Assoc. prof. Ayman Bakry
Dr. fadl Aysa