Exam 2

Instructions

Please write your answer based on the given instruction in each question. See below.

If the calculated result value is 894.6548, the rounding rule is as below.

- the right answer rounded to the nearest ones is 895
- the right answer rounded to the nearest tens is 890
- the right answer rounded to the first decimal place is 894.7
- the right answer rounded to the second decimal place is 894.65

Unless specified, assume density factor = 1.

This quiz was locked Nov 12 at 11:50am.

Attempt History

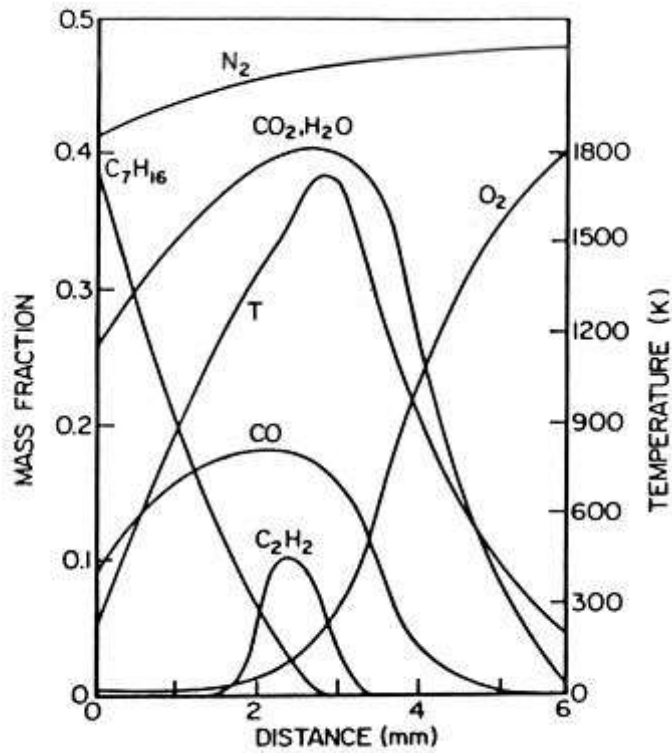|	Attempt	Time	Score
LATEST	Attempt 1 (https://canvas.okstate.edu/courses/137119/quizzes/349075/history?version=1)	88 minutes	91 out of 100

Score for this quiz: **91** out of 100
Submitted Nov 12 at 10:31am
This attempt took 88 minutes.

Question 1	3 / 3 pts

What is the distance [mm] at which the flame is established based on the figure below? Round your answer to the nearest ones without any units.

The graph shows MASS FRACTION (left y-axis, 0 to 0.5) and TEMPERATURE (K) (right y-axis, 0 to 1800) versus DISTANCE (mm) (x-axis, 0 to 6). Curves are labeled N_2, CO_2, H_2O, C_7H_{16}, O_2, T, CO, C_2H_2.

Correct!

3

Correct Answers   3 (with margin: 0)

Question 2   **3 / 3 pts**

Calculate the burning velocity [m/s] for the following conditions;

- The flame height is 3 cm,
- The fuel-air mixture flows through 3.1 cm diameter outlet, and
- The volume flow rate of the fuel is 0.2 L/s.

The Lateral cone surface area (excluding the base)= _____ with r(radius) and

h(height).

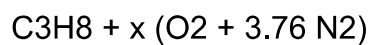Use   and round your answer to the first decimal place and do not include any units.

0.1

0.1

Question 3   3 / 3 pts

Propane (C3H8)'s LFL at 25ºC is 2.1 vol%. What is the value of x at LFL? Round your answer to the second decimal place.
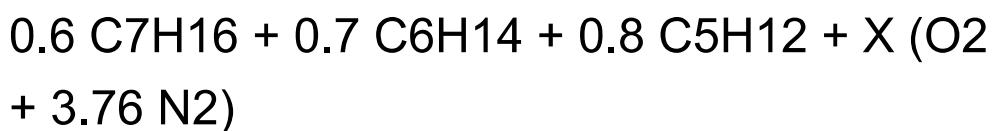
C3H8 + x (O2 + 3.76 N2)

9.79

9.79 (with margin: 0)

Below is the fuel mixture of heptane (C_7H_{16}), hexane (C_6H_{14}), and pentane (C_5H_{12}) reacting in the air at LFL. What is the value of "X?" Round your answer to the second decimal place.

LFLs are 1.1 Vol%, 1.2 Vol%, and 1.4 Vol%, respectively.

0.6 C7H16 + 0.7 C6H14 + 0.8 C5H12 + X (O2 + 3.76 N2)

Correct!

35.28

Correct Answer   35.28   margin of error +/- 1

For a fuel mixture consisting of 0.7 moles of heptane (C_7H_{16}), 0.8 moles of hexane (C_6H_{14}), and 0.6 moles of pentane (C_5H_{12}), what is the value of the stoichiometric air to fuel mass ratio? Round your answer to the first decimal place.

15.2

15.2   margin of error +/- 0.1

Question 6   3 / 3 pts

Calculate the lower flammable limit for a fuel mixture that contains 0.9 moles of heptane (C_7H_{16}), 0.6 moles of hexane (C_6H_{14}), and 0.9 moles of pentane (C_5H_{12}) at 25° LFLs of each fuel is 1.1 Vol%, 1.2 Vol%, and 1.4 Vol%, respectively. Round your answer to two decimal places and do not include any units.

1.22

1.22

Question 7   3 / 3 pts

Propane's LFL at 25 °C is 2.1 Vol%. Calculate the LFL (Vol%) of propane at 100°C. Round your answer to the second decimal place and do not include any units.

1.99

Question 8   3 / 3 pts

A stoichiometric Methane and air mixture needs to be diluted with an unknown inert gas (specific heat of 77 J/mole-K) to become non-flammable. Calculate the minimum amount of the inert gas in mole which should be added to Methane/air mixture per mole of Methane based on the critical adiabatic flame temperature approach (1600K). Round your answer to the second decimal place and do not include any units.

Methane(CH_4)'s heat of combustion is 50 kJ/g.

Specific heat of gases: CO_2 = 54.3 J/mole-K, H_2O = 41.3 J/mole-K, and N_2 = 32.7 J/mole-K.

3.01

3.01   margin of error +/- 0.01

Question 9   3 / 3 pts

Assuming an enclosure filled with the combustion products of a hydrocarbon fuel (C5H9) at stoichiometry at 1 atm, what is the vapor pressure of N2 in the enclosure in atm? Round your answer to two decimal places and do not include any unit.

0.74

0.74

Question 10   3 / 3 pts

Calculate flashpoint [$^{\circ}$C] of a substance with the following values. Round your answer to the nearest ones and do not include any unit.

$\log_{10} P = A - B/(T+C)$

where, P = vapor pressure (bar), T = temperature (K)

1 atm= 1.01325 bar.

LFL (Vol%) = 8.3, A = 5.15853, B = 1569.613, C = -34.846, ΔH_{vap}= 34.0 kJ/mole

8

Question 11   3 / 3 pts

The ignition temperature of a material is 301 °C. If the room is initially at 20 °C, when does the material reach the ignition temperature if exposed to a heat flux of 16 kW/m²? Assume thermally thin material, no heat losses, k=0.12 W/m-K, density=510 kg/m³, c_p=1.3 J/g-K, d=1 mm. Round your answer to the nearest ones and do not include any units.

Correct!

12

orrect Answer   12

Question 12   3 / 3 pts

Calculate the ignition time of a thermally thick material with the following conditions;

Thermal conductivity = 0.12 W/m-K, Density = 510 kg/m3, initial temperature = 20 °C, Specific heat = 1.3 J/g-K, d = 2 mm,   ,
minimum ignition surface temperature = 313 °C, Exposed heat flux = 18 kW/m²

Round your answer to the nearest ones and do not include any units.

17

17

Question 13

3 / 3 pts

Which parameter below influences the ignition time of a thermally thin material? Choose all of them.

- ☑ thickness

- ☐ thermal diffusivity

- ☐ thermal inertia

- ☑ applied external heat flux

Question 14

0 / 3 pts

Choose all that has a high propensity of self-ignition

- ○ A thin layer of coal dust

- ○ Grains in a cold storage

- ○ Crumpled cloth soaked with linseed oil

○ Gasoline vapor

Question 15   0 / 3 pts

The likelihood of self-ignition increases as the ratio of the exposed surface area to volume decreases.

○ True

⦿ False

Question 16   3 / 3 pts

Thermal- runaway occurs when heat loss rate is smaller than heat generation rate.

⦿ True

○ False

Question 17   3 / 3 pts

Pyrolysis is the thermal decomposition of solids and can occur without oxygen.

○ True

○ False

Question 18

3 / 3 pts

Closed-cup flashpoint is generally lower than open-cup flashpoint for a fuel.

◉ True

○ False

Question 19

0 / 3 pts

Diesel is a flammable liquid.

◉ True

○ False

Question 20

3 / 3 pts

From the experiment in the lab that we conducted, the following data were obtained. What is the maximum flame spread rate (mm/s)? Round your answer to the first decimal

place and do not include any unit.

Distance (mm)	0	20	40	60	80	100	120	140	160	180
Time to reach(s)	0	2	4	6	8	11	13.2	14.2	17.6	19.

◀ ▶

Correct!

20

orrect Answer   20

Question 21   3 / 3 pts

ASTM E84 Steiner Tunnel test is used to check the performance of interior wall and ceiling finishes.

The test results include flame spread index and smoke development index. However, it may not represent the performance of some plastic materials.

What is the reason for this?

Your Answer:

First of all, some plastic materials might be melting while heated by other resources, thus it is hard or even impossible to test the flame spread index and smoke development index. For one thing, the plastics

might not be able to maintain shape, for the other, there might not be a uniform flame speed in plastic.

Question 22   3 / 3 pts

A 500 gallon of heptane is suddenly released from a storage tank to a circular dike having a 1.8 m diameter. Calculate the fuel burning rate in kg/s from the dike. Round your answer to the second decimal place and do not include any units.

Below are the heptane properties.

- =3.14.
- gallon = 3.78 Liter.
- Heat of combustion of heptane = 44.6 [kJ/g]
- Mass burning rate per unit area for infinite diameter = 0.101 [kg/m2-s]
- Extinction coefficient multiplied by the mean beam length corrector = 1.1 [1/m]
- Density = 675 [kg/m3]

Correct!

0.22

rrect Answer   0.22   margin of error +/- 0.01

Question 23   3 / 3 pts

The wood log has been used as an effective fuel for a long period of time to increase the indoor temperature. One of the reasons is the long-burning period of wood due to the char layer on the wood surface.

Explain how the char layer can contribute to the long burning period.

Your Answer:

Then the wood log is heated, and there will be a dense char layer, just like a fireproof layer, on the surface of the wood. It can block the heat as well as the combustible gas from escaping the wood log.

For one thing, the radiation of heat is harder due to the char layer, for the other, the combustible derived from pyrolysis is locked, or at least, escapes slower from the char layer. Jointly, they reduce the burning speed, and that is the reason why the wood log has a long-burning period.

Question 24   31 / 31 pts

1+1 =?

○ 30

○ 0

Correct!   ◉ 2

○ 20