Exam1

Due No due date **Points** 100 **Questions** 21
Available Oct 1 at 9:18pm - Oct 2 at 12:08am 2 hours and 50 minutes
Time Limit 170 Minutes

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.

Best luck!

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	99 minutes	88 out of 100

Score for this quiz: **88** out of 100
Submitted Oct 1 at 10:58pm
This attempt took 99 minutes.

Question 1

3 / 3 pts

What is the value of "X" for the following stoichiometric chemical reaction?

$C_4H_8O_2 + X (O_2 + 3.76 N_2) \rightarrow Y CO_2 + Z H_2O + X (3.76 N_2)$

Correct!

5

orrect Answers

5 (with margin: 0)

Question 2 3 / 3 pts

What is the number of x for the mixture to represent air? Assume that air is composed of 21 vol% of Oxygen and 79 Vol% of Nitrogen. Round your answer to the second decimal place and do not include any units.

air: xO2+2.75N2

Correct!

0.73

orrect Answer

0.73 margin of error +/- 0.01

Question 3 3 / 3 pts

Calculate the heat of combustion of C3H8 burning in air in kJ/mole using the following values. Write down your answer to the first decimal place without any units.

- Heat of formation: C3H8 = -103.8 kJ/mole, CO2 = -393.5 kJ/mole, H2O = -241.8 kJ/mole

Correct!

2,043.9

orrect Answers

2,043.9 (with margin: 1)

Question 4 0 / 3 pts

Calculate the heat of combustion of C2H4 burning in air in kJ/g using the following values. Write down your answer to the first decimal place without any units.

- Heat of formation: C2H4 = 52.5 kJ/mole, CO2 = -393.5 kJ/mole, H2O = -241.8 kJ/mole

ou Answered

1,323.1

orrect Answers

47.3 (with margin: 1)

Question 5 3 / 3 pts

What is the representative heat of combustion value that we agreed for most hydrocarbon fuels in kJ/g?

Write down your answer rounded to the nearest ones without any units.

Correct!

45

Correct Answers

45 (with margin: 1)

Question 6 3 / 3 pts

Calculate the enthalpy of propane in kJ/mole at 1,018K assuming a representative specific heat value of 128.7 J/mole-K from 298 K to 1,018K. The heat of formation of propane is -103.8 kJ/mole. Write down your answer rounded to the first decimal place without units.

Correct!

-11.1

Correct Answer

-11.1 margin of error +/- 0.1

Question 7 3 / 3 pts

Calculate the mass of propane (C3H8) in gram for the following conditions. Round your answer to the first decimal place and do not include any units.

- P = 1 atm = 101325 Pa = 1.01325 bar = 14.7 psi,

- V = 8 L,
- R = 8.314 J/mole-K,
- T = 605 K.

Correct!

7.1

Correct Answer

7.1 margin of error +/- 0.1

Question 8

3 / 3 pts

Assuming that 11 g of a fuel is stoichiometrically reacting with 4 g of air. What is HRR in KW when 133 g/s of fuel is burned? Round your answer to the nearest ones and do not include any units.

Correct!

145

Correct Answer

145 margin of error +/- 1

Question 9

3 / 3 pts

What parameter below has a unit of **W/m2-K?**

- Heat release rate
- Radiant heat flux
- Thermal conductivity

Correct!

- Convective heat transfer coefficient

Question 10 3 / 3 pts

Calculate the mass flow rate [kg/s] of air in a 11 inch round duct (in diameter).

Air flow velocity is 9,893 feet per min and the temperature is 56 °C.

Use air density = 1.2 kg/m^3 at 20°C. Round your answer to the first decimal place and do not include any units.

Correct!

3.3

Correct Answer 3.3 margin of error +/- 0.05

Question 11 0 / 3 pts

Calculate the average velocity of the outflow from the compartment with the following conditions in m/s. Round your answer to the first decimal place and do not include any units.

- Single room with one door opening
- Temp: 25°C, Amb. Density: 1.2 kg/m^3
- Opening height: 2.1 m from the floor
- Neutral plane height: 41% of the opening height

- Compartment upper layer temperature is 280 °C

ou Answered

3.6

orrect Answer

3 margin of error +/- 0.1

Question 12 0 / 3 pts

What would be the room upper temperature in Celsius to generate 2.31 m/s average velocity of incoming flow in a room fire? Write your answer rounded to the nearest ones without units.

Assumption:

- Single room with one door opening
- Ambient air Temp. = 20 °C,
- Ambient air density = 1.2 kg/m3
- gravity = 9.81 m/s2
- Opening height = 2.1 m
- Opening width = 0.9 m
- Neutral plane height from the bottom of opening = 0.91 m

ou Answered

622

orrect Answer 602 margin of error +/- 1%

Question 13 3 / 3 pts

Calculate adiabatic flame temperature (K) of Butane(C4H10) burning in the air with the initial temperature of 298K and 1 atm. Write down your answer to the nearest ones without units.

- Specific heat: CO2 = 54.3 J/mole-K, H2O = 41.3 J/mole-K, N2 = 32.7 J/mole-K.
- Heat of formation: fuel = -124.7 kJ/mole, CO2 = -393.5 kJ/mole, H2O = -241.8 kJ/mole

Correct! 2,472

orrect Answers 2,472 (with margin: 3)

Question 14 3 / 3 pts

A fire in a room increases the interior wall surface temperature and maintains it at 1,111 °C. The outside ambient temperature is 20 °C. If the wall is made of 200 mm brick, calculate

the steady-state exterior wall surface temperature in Celsius? Write down your answer rounded to the nearest ones without any units.

- Thermal conductivity of brick = 0.7 W/m-K
- Convective heat transfer coefficient = 13 W/m2-K

Correct!

251

Correct Answer 251 margin of error +/- 1

Question 15 3 / 3 pts

Assuming thermally thick behavior, 39 kW/m^2 heat flux was applied to a 3 mm thick wood veneer for 22 sec. The initial ambient temperature was 299 K and convective heat transfer coefficient was 20 W/m2-K. calculate the surface temperature of the wood veneer in Celsius. Write down your answer rounded to the nearest ones without units.

- Wood veneer properties:

Thermal conductivity of wood veneer = 0.15 W/m-K, density = 580 kg/m3, specific heat = 1750 J/kg-K, surface absorptivity = 0.85.

Below is the complementary error function table.

x	Hundredths digit of x									
	0	1	2	3	4	5	6	7	8	9
0.0	1.00000	0.98872	0.97744	0.96616	0.95489	0.94363	0.93238	0.92114	0.90992	0.89872
0.1	0.88754	0.87638	0.86524	0.85413	0.84305	0.83200	0.82099	0.81001	0.79906	0.78816
0.2	0.77730	0.76648	0.75570	0.74498	0.73430	0.72367	0.71310	0.70258	0.69212	0.68172
0.3	0.67137	0.66109	0.65087	0.64072	0.63064	0.62062	0.61067	0.60079	0.59099	0.58126
0.4	0.57161	0.56203	0.55253	0.54311	0.53377	0.52452	0.51534	0.50625	0.49725	0.48833
0.5	0.47950	0.47076	0.46210	0.45354	0.44506	0.43668	0.42838	0.42018	0.41208	0.40406
0.6	0.39614	0.38832	0.38059	0.37295	0.36541	0.35797	0.35062	0.34337	0.33622	0.32916
0.7	0.32220	0.31533	0.30857	0.30190	0.29532	0.28884	0.28246	0.27618	0.26999	0.26390
0.8	0.25790	0.25200	0.24619	0.24048	0.23486	0.22933	0.22390	0.21856	0.21331	0.20816
0.9	0.20309	0.19812	0.19323	0.18844	0.18373	0.17911	0.17458	0.17013	0.16577	0.16149
1.0	0.15730	0.15319	0.14916	0.14522	0.14135	0.13756	0.13386	0.13023	0.12667	0.12320
1.1	0.11979	0.11647	0.11321	0.11003	0.10692	0.10388	0.10090	0.09800	0.09516	0.09239
1.2	0.08969	0.08704	0.08447	0.08195	0.07949	0.07710	0.07476	0.07249	0.07027	0.06810
1.3	0.06599	0.06394	0.06193	0.05998	0.05809	0.05624	0.05444	0.05269	0.05098	0.04933
1.4	0.04771	0.04615	0.04462	0.04314	0.04170	0.04030	0.03895	0.03763	0.03635	0.03510
1.5	0.03389	0.03272	0.03159	0.03048	0.02941	0.02838	0.02737	0.02640	0.02545	0.02454
1.6	0.02365	0.02279	0.02196	0.02116	0.02038	0.01962	0.01890	0.01819	0.01751	0.01685
1.7	0.01621	0.01559	0.01500	0.01442	0.01387	0.01333	0.01281	0.01231	0.01183	0.01136
1.8	0.01091	0.01048	0.01006	0.00965	0.00926	0.00889	0.00853	0.00818	0.00784	0.00752
1.9	0.00721	0.00691	0.00662	0.00634	0.00608	0.00582	0.00557	0.00534	0.00511	0.00489
2.0	0.00468	0.00448	0.00428	0.00409	0.00391	0.00374	0.00358	0.00342	0.00327	0.00312
2.1	0.00298	0.00285	0.00272	0.00259	0.00247	0.00236	0.00225	0.00215	0.00205	0.00195
2.2	0.00186	0.00178	0.00169	0.00161	0.00154	0.00146	0.00139	0.00133	0.00126	0.00120
2.3	0.00114	0.00109	0.00103	0.00098	0.00094	0.00089	0.00085	0.00080	0.00076	0.00072
2.4	0.00069	0.00065	0.00062	0.00059	0.00056	0.00053	0.00050	0.00048	0.00045	0.00043
2.5	0.00041	0.00039	0.00037	0.00035	0.00033	0.00031	0.00029	0.00028	0.00026	0.00025
2.6	0.00024	0.00022	0.00021	0.00020	0.00019	0.00018	0.00017	0.00016	0.00015	0.00014
2.7	0.00013	0.00013	0.00012	0.00011	0.00011	0.00010	0.00009	0.00009	0.00008	0.00008
2.8	0.00008	0.00007	0.00007	0.00006	0.00006	0.00006	0.00005	0.00005	0.00005	0.00004
2.9	0.00004	0.00004	0.00004	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002
3.0	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001
3.1	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
3.2	0.00001	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Correct!

394

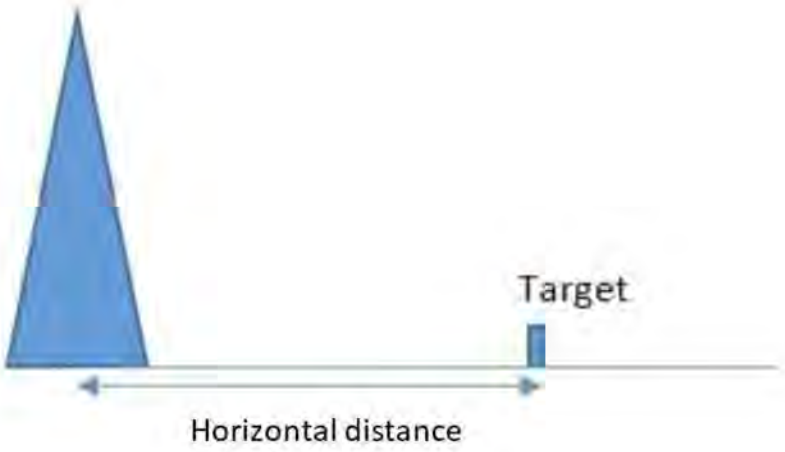
ɔrrect Answer

394 margin of error +/- 2

Question 16

3 / 3 pts

Heptane spills and forms a pool fire in a dike area of 8 m diameter. Calculate heat flux in kW/m2 on the exposed surface of the target horizontally 22 m away from the base of fire. Assume the followings: point source height = 13 m, heat release rate = 116 MW, radiative fraction = 0.66. Write down your answer rounded to the first decimal place without any units.

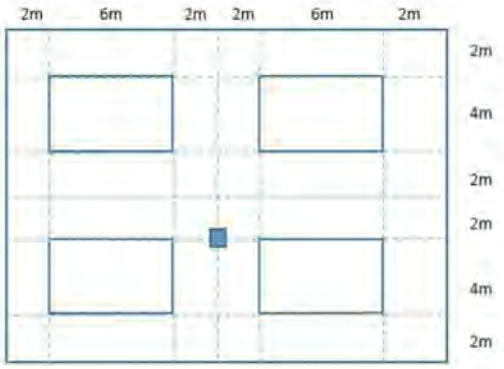


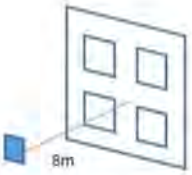
Correct! 8

orrect Answer 8 margin of error +/- 0.2

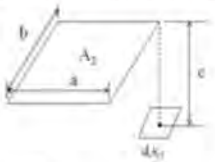
Question 17 3 / 3 pts

Calculate the radiative heat flux in kW/m2 on the target which is 8 m away from the surface of the window openings. Assume the emissivity of the window opening is 0.9 and the surface temperature 1200K. Write down your answer rounded to the nearest ones without any units.





Configuration factor equation (SFPE HB p.A-48)



Plane element dA_1 to plane parallel rectangle. Normal to element passes through corner of rectangle

$$X = \frac{a}{c} \qquad Y = \frac{b}{c}$$

$$F_{dA1} = \frac{1}{2\pi}\left(\frac{X}{\sqrt{1+X^2}}\tan^{-1}\frac{Y}{\sqrt{1+X^2}} + \frac{Y}{\sqrt{1+Y^2}}\tan^{-1}\frac{X}{\sqrt{1+Y^2}}\right)$$

a	b	c	X	Y	View factor
8	8	8	1	1	0.139
8	6	8	1	0.75	0.119
8	4	8	1	0.5	0.09
8	6	8	1	0.75	0.119
8	2	8	1	0.25	0.049
6	2	8	0.75	0.25	0.043
2	4	8	0.25	0.5	0.033
2	2	8	0.25	0.25	0.018

Correct

19

Correct Answers

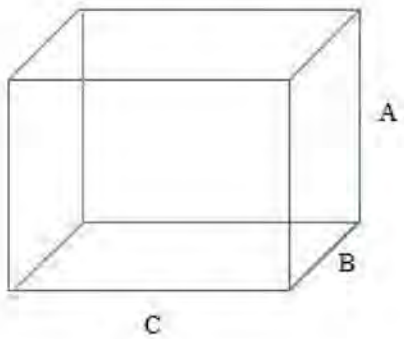
19 (with margin: 0)

Question 18

0 / 3 pts

Calculate the fraction of the radiation leaving the walls and ceiling to the floor for the following configuration. Write down your answer rounded to the second decimal point without units.

A=4 m, B= 8 m, C = 9 m



ou Answered

0.21

orrect Answer

0.35 margin of error +/- 0.01

Question 19 3 / 3 pts

Only one side of a 2 mm thick steel wall was suddenly exposed to 500 °C air stream. Calculate the surface temperature of the steel in Celsius at 12 sec with a time step of 4 sec. Write down your answer rounded to the nearest ones without units.

- Initial temperature = 20 °C
- Convective heat transfer coefficient on both sides = 10 W/m2-K
- Steel specific heat = 460 J/kg-K
- Steel density = 7500 kg/m3

Correct!

28

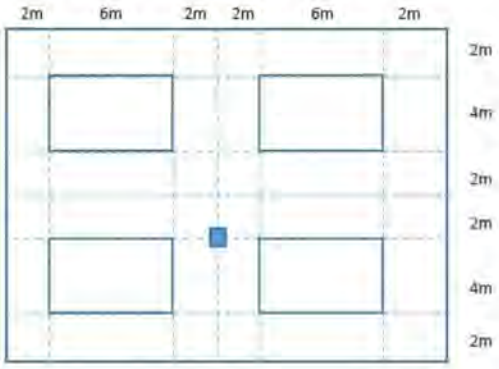
27

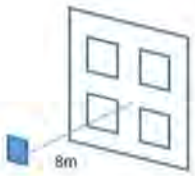
26

29

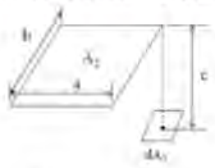
Question 20 3 / 3 pts

Calculate the radiative heat flux in kW/m2 on the target which is 8 m away from the surface of the window openings. Assume the emissivity of the window opening is 0.9 and the surface temperature 1000 C. Write down your answer rounded to the nearest ones without any units.





Configuration factor equation (SFPE HB p.4-48)



$$X = \frac{a}{c} \qquad Y = \frac{b}{c}$$

$$F_{d1-2} = \frac{1}{2\pi}\left(\frac{X}{\sqrt{1+X^2}}\tan^{-1}\frac{Y}{\sqrt{1+X^2}} + \frac{Y}{\sqrt{1+Y^2}}\tan^{-1}\frac{X}{\sqrt{1+Y^2}}\right)$$

a	b	c	X	Y	View factor
8	8	8	1	1	0.139
8	6	8	1	0.75	0.119
8	4	8	1	0.5	0.09
8	6	8	1	0.75	0.119
8	2	8	1	0.25	0.049
6	2	8	0.75	0.25	0.043
2	4	8	0.25	0.5	0.033
2	2	8	0.25	0.25	0.018

Correct!

24

Correct Answers 24 (with margin: 0)

Question 21

40 / 40 pts

1+1=?

112

911

Correct!

- (•) 2
- ( ) 119

Quiz Score: **88** out of 100

Exam 2

Due Nov 12 at 11:50am **Points** 100 **Questions** 24
Available until Nov 12 at 11:50am **Time Limit** 170 Minutes

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.

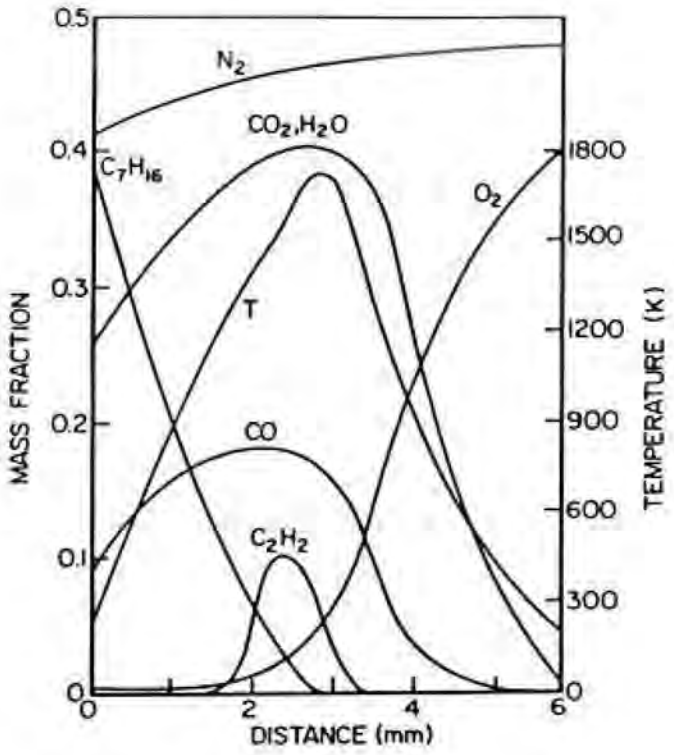
Attempt History

	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.



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.

Correct!

0.1

Correct Answer

0.1

Question 3

3 / 3 pts

Propane (C3H8)'s LFL at 25°C 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)

Correct!

9.79

Correct Answers

9.79 (with margin: 0)

Question 4 3 / 3 pts

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

Question 5 3 / 3 pts

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.

Correct!

15.2

orrect Answer

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.

Correct!

1.22

orrect Answer

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.

Correct!

1.99

orrect Answer 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(CH4)'s heat of combustion is 50 kJ/g.

Specific heat of gases: CO2 = 54.3 J/mole-K, H2O = 41.3 J/mole-K, and N2 = 32.7 J/mole-K.

Correct! 3.01

orrect Answer 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.

Correct!

0.74

Correct Answer

0.74

Question 10 3 / 3 pts

Calculate flashpoint [^{o}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

Correct!

8

orrect Answer 8 margin of error +/- 1

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/m^2? Assume thermally thin material, no heat losses, k=0.12 W/m-K, density=510 kg/m^3, 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/m^2

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

Correct!

17

Correct Answer 17

Question 13 3 / 3 pts

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

Correct!

- [x] thickness
- [ ] thermal diffusivity
- [ ] thermal inertia

Correct!

- [x] 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

Correct Answer

- [ ] Crumpled cloth soaked with linseed oil

:u Answered

Gasoline vapor

Question 15 0 / 3 pts

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

:rrect Answer

True

:u Answered

False

Question 16 3 / 3 pts

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

Correct!

True

False

Question 17 3 / 3 pts

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

Correct!

True

False

Question 18 3 / 3 pts

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

Correct!

True

False

Question 19 0 / 3 pts

Diesel is a flammable liquid.

ou Answered

True

orrect Answer

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	18(
Time to reach(s)	0	2	4	6	8	11	13.2	14.2	17.6	19.

Correct!

20

Correct 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
- 2 (Correct!)
- 20

Quiz Score: **91** out of 100

HW1_after Heat of combustion and unit conversion

Due Sep 5 at 12:59pm **Points** 11 **Questions** 7
Available Aug 30 at 11am - Sep 5 at 12:59pm **Time Limit** None
Allowed Attempts 3

This quiz was locked Sep 5 at 12:59pm.

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1 (https://canvas.okstate.edu/courses/137119/quizzes/349078/history?version=1)	1,324 minutes	11 out of 11

Correct answers are hidden.

Score for this attempt: **11** out of 11
Submitted Sep 4 at 1:37pm
This attempt took 1,324 minutes.

Question 1

1 / 1 pts

What is the value of x for the following stoichiometric chemical reaction?

$CH4O + x (O2 + 3.76 N2) \rightarrow Y CO2 + Z H2O + x (3.76 N2)$

1.5

Question 2

1 / 1 pts

What composition below represents air? Assume that air is composed of 21 vol% of Oxygen and 79 Vol% of Nitrogen.

- 1.2 O2 + 4.51 N2
- 10 O2 + 36.7 N2
- 0.21 O2 + 3.76 N2
- 2 O2 + 3.76 N2

Question 3 1 / 1 pts

Calculate the heat of combustion of heptane (C7H16) burning in air in kJ/mole. Round your answer to the first decimal place and do not include any units.

Use the following values:

- Specific heat: CO2 = 54.3 J/mole-K, H2O = 41.3 J/mole-K, N2 = 32.7 J/mole-K.
- Heat of formation: C7H16 = -187.8 kJ/mole, CO2 = -393.5 kJ/mole, H2O = -241.8 kJ/mole

4,501.1

Question 4 1 / 1 pts

Calculate the enthalpy of propane in kJ/mole at 1000K assuming a representative specific heat value of 128.7 J/mole-K from 298 K to 1000K. The heat of formation of propane is -103.8 kJ/mole. Write down your answer rounded to the first decimal place without units.

-13.5

Question 5 1 / 1 pts

Using the Ideal Gas Law, calculate the mass (g) of ethylene (C_2H_4) given the following conditions.

Write down your answer rounded to the first decimal place without units.

P = 1 atm = 101325 Pa = 1.01325 bar = 14.7 psi

V = 25 L

R = 8.314 J/mol-K

T = 303 K

28.2

Question 6 5 / 5 pts

Assuming that 10 g of a fuel is stoichiometrically reacting with 2 g of air. What is HRR [kW] when 148 g/s of fuel is burned? Round your answer to the first decimal place and do not include any units.

88.8

Question 7 1 / 1 pts

C4H10 is burning in air. Assuming stoichiometric combustion, calculate the amount of heat (kJ) generated per g of O2 reacted. Write down your answer rounded to the first decimal place without units.

- Heat of formation: C4H10 = -124.7 kJ/mole, CO2 = -393.5 kJ/mole, H2O = -241.8 kJ/mole

12.8

Quiz Score: **11** out of 11

HW 2_after adiabatic flame temp and vent flows

Due Sep 16 at 12:59pm **Points** 4 **Questions** 4 **Time Limit** None
Allowed Attempts 3

Take the Quiz Again (https://canvas.okstate.edu/courses/137119/quizzes/349070/take?user_id=220308)

Attempt History

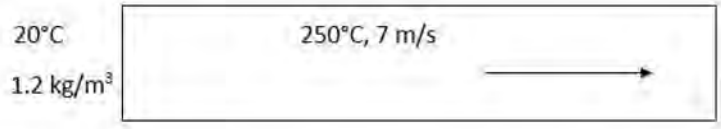
	Attempt	Time	Score
LATEST	Attempt 1 (https://canvas.okstate.edu/courses/137119/quizzes/349070/history?version=1)	312 minutes	4 out of 4

Correct answers are hidden.

Score for this attempt: **4** out of 4
Submitted Sep 15 at 4:26pm
This attempt took 312 minutes.

Question 1 — 1 / 1 pts

Calculate the mass flow rate [kg/s] in a circular duct with a 12" diameter with the shown conditions:



0.34

Question 2 1 / 1 pts

Calculate the average velocity of the outflow from the compartment with the following conditions in m/s.

- Single room with one door opening
- Temp: 25°C, Amb. Density: 1.2 kg/m^3
- Opening height: 2.1 m, opening width: 0.9 m
- Neutral plane height: 40 % of the opening height
- Compartment upper layer temperature is 269 ^oC

- 3 m/s
- 4 m/s
- 5 m/s
- 6 m/s

Question 3 1 / 1 pts

What would be the room upper temperature in Celsius to generate 4.8 m/s average velocity of

outgoing flow in a room fire? Write your answer rounded to the nearest tens without units.

Assumption:

- Single room with one door opening
- temp.: 20 °C, Amb. density: 1.2 kg/m3
- Opening height: 2.1 m, opening width: 0.9 m
- Neutral plane height: 0.92 m

677.6

Question 4 1 / 1 pts

Calculate adiabatic flame temperature (K) of Butane(C4H10) burning in the air with the initial temperature of 298K and 1 atm. Write down your answer to the nearest ones without units.

- Specific heat: CO2 = 54.3 J/mole-K, H2O = 41.3 J/mole-K, N2 = 32.7 J/mole-K.
- Heat of formation: fuel = -124.7 kJ/mole, CO2 = -393.5 kJ/mole, H2O = -241.8 kJ/mole

2,472

Quiz Score: **4** out of 4

HW3_after Heat transfer conduction and convection

Due Sep 28 at 12:59pm **Points** 3 **Questions** 3 **Time Limit** None
Allowed Attempts 3

Take the Quiz Again (https://canvas.okstate.edu/courses/137119/quizzes/349079/take?user_id=220308)

Attempt History

	Attempt	Time	Score
KEPT	Attempt 2 (https://canvas.okstate.edu/courses/137119/quizzes/349079/history?version=2)	less than 1 minute	3 out of 3
LATEST	Attempt 2 (https://canvas.okstate.edu/courses/137119/quizzes/349079/history?version=2)	less than 1 minute	3 out of 3
	Attempt 1 (https://canvas.okstate.edu/courses/137119/quizzes/349079/history?version=1)	1,949 minutes	2 out of 3

Correct answers are hidden.

Score for this attempt: **3** out of 3
Submitted Sep 27 at 9:42pm
This attempt took less than 1 minute.

Question 1 1 / 1 pts

A fire in a room increases the interior wall surface temperature and maintains it at 800 ^{o}C. The outside ambient air temperature is 20 ^{o}C. If the wall is made of 200 mm brick, calculate the steady-state exterior wall surface

temperature[C]. Write down your answer rounded to the nearest ones without any units.

- Thermal conductivity of brick = 0.7 W/m-K
- Convective heat transfer coefficient = 15 W/m2-K

- (●) 168
- ( ) 142
- ( ) 240
- ( ) 254

Question 2 1 / 1 pts

Only one side of a 2 mm thick steel wall was suddenly exposed to 500 ^{o}C air stream. Calculate the surface temperature of the steel in Celsius at 12 sec with a time step of 4 sec. Write down your answer rounded to the nearest ones without units.

- Initial temperature = 20 ^{o}C
- Convective heat transfer coefficient on both sides = 10 W/m2-K
- Steel specific heat = 460 J/kg-K
- Steel density = 7500 kg/m3

- (●) 28

- 29
- 26
- 27

Question 3 **1 / 1 pts**

Assuming thermally thick behavior, 40 kW/m^2 heat flux was applied to a 3 mm thick wood veneer for 15 sec. The initial ambient temperature was 300K and convective heat transfer coefficient was 20 W/m2-K. calculate the surface temperature of the wood veneer in Celsius. Write down your answer rounded to the nearest tens without units.

- Wood veneer properties:

Thermal conductivity of wood veneer = 0.15 W/m-K, density = 580 kg/m3, specific heat = 1750 J/kg-K, surface absorptivity = 0.85.

Below is the complementary error function table.

x	Hundredths digit of x									
	0	1	2	3	4	5	6	7	8	9
0.0	1.00000	0.98872	0.97744	0.96616	0.95489	0.94363	0.93238	0.92114	0.90992	0.89872
0.1	0.88754	0.87638	0.86524	0.85413	0.84305	0.83200	0.82099	0.81001	0.79906	0.78816
0.2	0.77730	0.76648	0.75570	0.74498	0.73430	0.72367	0.71310	0.70258	0.69212	0.68172
0.3	0.67137	0.66109	0.65087	0.64072	0.63064	0.62062	0.61067	0.60079	0.59099	0.58126
0.4	0.57161	0.56203	0.55253	0.54311	0.53377	0.52452	0.51534	0.50625	0.49725	0.48833
0.5	0.47950	0.47076	0.46210	0.45354	0.44506	0.43668	0.42838	0.42018	0.41208	0.40406
0.6	0.39614	0.38832	0.38059	0.37295	0.36541	0.35797	0.35062	0.34337	0.33622	0.32916
0.7	0.32220	0.31533	0.30857	0.30190	0.29532	0.28884	0.28246	0.27618	0.26999	0.26390
0.8	0.25790	0.25200	0.24619	0.24048	0.23486	0.22933	0.22390	0.21856	0.21331	0.20816
0.9	0.20309	0.19812	0.19323	0.18844	0.18373	0.17911	0.17458	0.17013	0.16577	0.16149
1.0	0.15730	0.15319	0.14916	0.14522	0.14135	0.13756	0.13386	0.13023	0.12667	0.12320
1.1	0.11979	0.11647	0.11321	0.11003	0.10692	0.10388	0.10090	0.09800	0.09516	0.09239
1.2	0.08969	0.08704	0.08447	0.08195	0.07949	0.07710	0.07476	0.07249	0.07027	0.06810
1.3	0.06599	0.06394	0.06193	0.05998	0.05809	0.05624	0.05444	0.05269	0.05098	0.04933
1.4	0.04771	0.04615	0.04462	0.04314	0.04170	0.04030	0.03895	0.03763	0.03635	0.03510
1.5	0.03389	0.03272	0.03159	0.03048	0.02941	0.02838	0.02737	0.02640	0.02545	0.02454
1.6	0.02365	0.02279	0.02196	0.02116	0.02038	0.01962	0.01890	0.01819	0.01751	0.01685
1.7	0.01621	0.01559	0.01500	0.01442	0.01387	0.01333	0.01281	0.01231	0.01183	0.01136
1.8	0.01091	0.01048	0.01006	0.00965	0.00926	0.00889	0.00853	0.00818	0.00784	0.00752
1.9	0.00721	0.00691	0.00662	0.00634	0.00608	0.00582	0.00557	0.00534	0.00511	0.00489
2.0	0.00468	0.00448	0.00428	0.00409	0.00391	0.00374	0.00358	0.00342	0.00327	0.00312
2.1	0.00298	0.00285	0.00272	0.00259	0.00247	0.00236	0.00225	0.00215	0.00205	0.00195
2.2	0.00186	0.00178	0.00169	0.00161	0.00154	0.00146	0.00139	0.00133	0.00126	0.00120
2.3	0.00114	0.00109	0.00103	0.00098	0.00094	0.00089	0.00085	0.00080	0.00076	0.00072
2.4	0.00069	0.00065	0.00062	0.00059	0.00056	0.00053	0.00050	0.00048	0.00045	0.00043
2.5	0.00041	0.00039	0.00037	0.00035	0.00033	0.00031	0.00029	0.00028	0.00026	0.00025
2.6	0.00024	0.00022	0.00021	0.00020	0.00019	0.00018	0.00017	0.00016	0.00015	0.00014
2.7	0.00013	0.00013	0.00012	0.00011	0.00011	0.00010	0.00009	0.00009	0.00008	0.00008
2.8	0.00008	0.00007	0.00007	0.00006	0.00006	0.00006	0.00005	0.00005	0.00005	0.00004
2.9	0.00004	0.00004	0.00004	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002
3.0	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001
3.1	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
3.2	0.00001	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

350

Quiz Score: **3** out of 3

HW4_after heat transfer_radiation due before exam1

Due Sep 28 at 12:59pm **Points** 2 **Questions** 2 **Time Limit** None
Allowed Attempts 3

Take the Quiz Again (https://canvas.okstate.edu/courses/137119/quizzes/349076/take?user_id=220308)

Attempt History

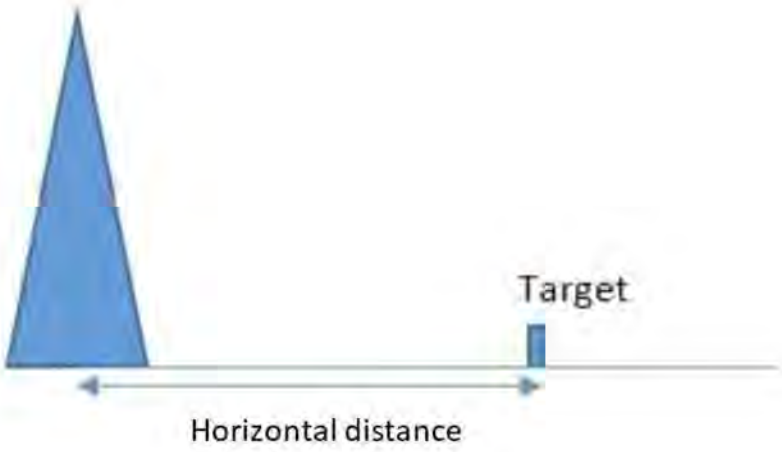
	Attempt	Time	Score
LATEST	Attempt 1 (https://canvas.okstate.edu/courses/137119/quizzes/349076/history?version=1)	1,753 minutes	2 out of 2

Correct answers are hidden.

Score for this attempt: **2** out of 2
Submitted Sep 27 at 5:31pm
This attempt took 1,753 minutes.

Question 1 1 / 1 pts

Heptane spills and forms a pool fire in a dike area of 9 m diameter. Calculate heat flux in kW/m2 on the exposed surface of the target horizontally 20 m away from the base of fire? Assume the followings: flame height = 30 m (point source height = 15 m), heat release rate = 120 MW, radiative fraction = 0.7. Write down your answer rounded to the nearest ones without any units.



9

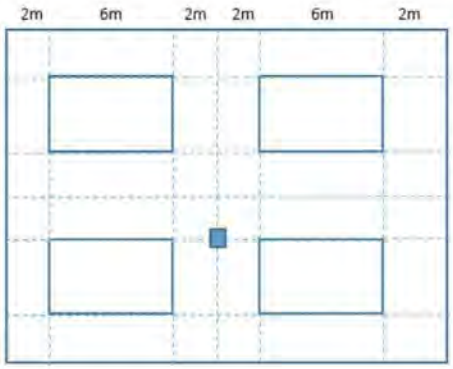
13

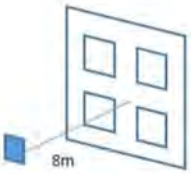
17

20

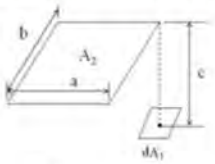
Question 2 1 / 1 pts

Calculate the radiative heat flux in kW/m2 on the target which is 8 m away from the surface of the window openings. Assume the emissivity of the window opening is 0.9 and the surface temperature 1200K. Write down your answer rounded to the nearest ones without any units.





Configuration factor equation (SFPE HB. p.A-48)



Plane element dA_1 to plane parallel rectangle: Normal to element passes through corner of rectangle

$$X = \frac{a}{c} \qquad Y = \frac{b}{c}$$

$$F_{d1\text{-}2} = \frac{1}{2\pi}\left(\frac{X}{\sqrt{1+X^2}}\tan^{-1}\frac{Y}{\sqrt{1+X^2}} + \frac{Y}{\sqrt{1+Y^2}}\tan^{-1}\frac{X}{\sqrt{1+Y^2}}\right)$$

a	b	c	X	Y	View factor
8	8	8	1	1	0.139
8	6	8	1	0.75	0.119
8	4	8	1	0.5	0.09
8	6	8	1	0.75	0.119
8	2	8	1	0.25	0.049
6	2	8	0.75	0.25	0.043
2	4	8	0.25	0.5	0.033
2	2	8	0.25	0.25	0.018

19

Quiz Score: **2** out of 2

HW5_after LFL and UFL 2

Due Oct 17 at 12:59pm **Points** 15 **Questions** 7 **Time Limit** None
Allowed Attempts 3

Take the Quiz Again

Attempt History

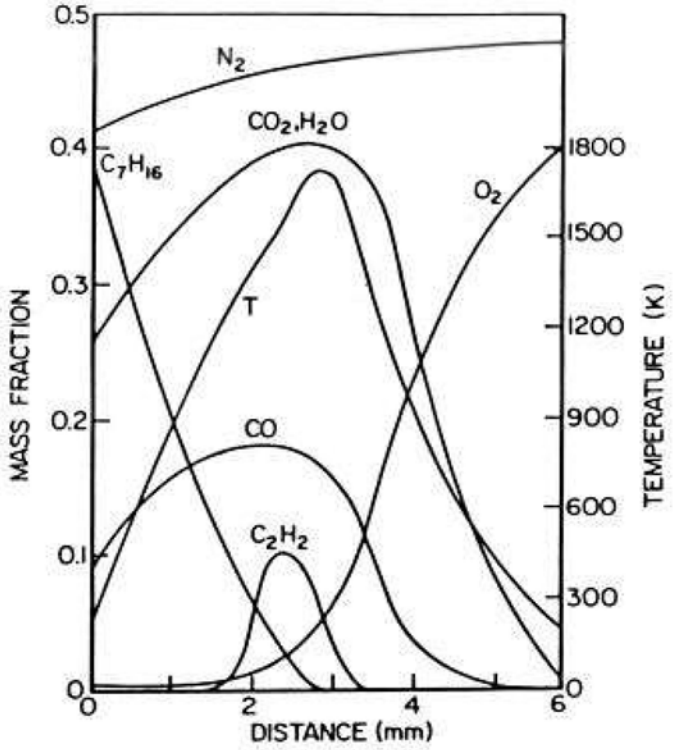
	Attempt	Time	Score
LATEST	Attempt 1	583 minutes	15 out of 15

ⓘ Correct answers are hidden.

Score for this attempt: **15** out of 15
Submitted Oct 16 at 9:35pm
This attempt took 583 minutes.

Question 1 — 1 / 1 pts

What is the chemical formula of the fuel in the figure below?



- C7H16
- CO
- C2H2
- CO2

Question 2 **5 / 5 pts**

Calculate the flame height from the outlet if;

- The laminar burning velocity of the fuel is 0.5 m/s,
- The fuel-air mixture flows through 2 cm diameter outlet, and
- The volume flow rate of the fuel is 0.4L/s.

The Lateral cone surface area (excluding the base)= $\pi r\sqrt{h^2+r^2}$ with r(radius) and h(height).

- 0.023 m
- 0.017 m
- 0.019 m
- 0.021 m

Question 3 **1 / 1 pts**

Pentane (C_5H_{12})'s LFL at 25°C is 1.4 vol%. What is the value of x at LFL? Round your answer to the first decimal place.

C5H12 + x (O2 + 3.76 N2)

14.8

Question 4

1 / 1 pts

Below is the fuel mixture consisting of 0.2 moles of heptane (C_7H_{16}), 0.6 moles of hexane (C_6H_{14}), and 1.2 moles of pentane (C_5H_{12}) reacting in the air at LFL. What is the value of "X ? "

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

0.2C7H16 + 0.6 C6H14 + 1.2 C5H12 + X (O2 + 3.76 N2)

- (●) 31.9
- ( ) 36.8
- ( ) 35.5
- ( ) 30.9

Question 5

1 / 1 pts

For a fuel mixture consisting of 0.2 moles of heptane (C_7H_{16}), 0.6 moles of hexane (C_6H_{14}), and 1.2 mole of pentane (C_5H_{12}), what is the value of the stoichiometric air to fuel mass ratio? 15.2

If this mixture is at LFL, what is the equivalence ratio? 0.55

LFLs of each fuel is 1.1 Vol%, 1.2 Vol%, and 1.4 Vol%, respectively.

Answer 1:

15.2

Answer 2:

0.55

Question 6

1 / 1 pts

Calculate the lower flammable limit for a fuel mixture that contains 0.2 moles of heptane (C_7H_{16}), 0.6 moles of hexane (C_6H_{14}), and 1.2 mole of pentane (C_5H_{12}) at 25°C. LFLs of each fuel is 1.1 Vol%, 1.2 Vol%, and 1.4 Vol%, respectively.

- 1.3 Vol%
- 1.1 Vol%
- 1.2 Vol%
- 1.4 Vol%

Question 7

5 / 5 pts

Methane's LFL at 25 °C is 5 Vol%. Calculate the LFL (Vol%) of methane at 50°C. Round your answer to the second decimal place and do not include any units.

4.91

Quiz Score: **15** out of 15

HW6_after ignition 2

Due Oct 28 at 12:59pm **Points** 9 **Questions** 5 **Time Limit** None
Allowed Attempts 3

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	4,679 minutes	9 out of 9

ⓘ Correct answers are hidden.

Score for this attempt: **9** out of 9
Submitted Oct 27 at 9:42pm
This attempt took 4,679 minutes.

Question 1 — 1 / 1 pts

An OSU FPST alumni developed a new fire suppressant which is composed of 20 vol% of N2 and 80 vol % of CO2. How many moles of this suppressant should be added to extinguish one mole of methane flame? Use the critical adiabatic flame temperature at LFL. Methane's heat of combustion is 50 kJ/g.

Use the following specific heat values:

CO2 = 54.3 J/mole-K, H2O = 41.3 J/mole-K, N2 = 32.7 J/mole-K.

- 4.6 moles
- 2.3 moles
- 3.5 moles
- 5.9 moles

Question 2 5 / 5 pts

Assuming an enclosure filled with the combustion products of methane at stoichiometry at 1 atm, what is the vapor pressure of H2O in the enclosure in atm? Round your answer to two decimal places and do not include any unit.

0.19

Question 3 1 / 1 pts

Calculate flashpoint [^{o}C] of methanol with the following values.

log10P=A - B/(T+C)

where, P = vapor pressure [bar], T = temperature [K]

LFL (Vol%) = 6.7, A = 5.15853, B = 1569.613, C = -34.846, ΔH_{vap}= 38.3 kJ/mole

9

-9

6

- -6

Question 4

1 / 1 pts

The ignition temperature of a material is 350 °C. If the room is initially at 20 °C, when does the material reach the ignition temperature if exposed to a heat flux of 10 kW/m^2? Assume thermally thin material, no heat losses, k=0.12 W/m-K, density=510 kg/m^3, c_p=1.3 J/g-K, d=1 mm.

- (•) 22 sec
- ( ) 40 sec
- ( ) 218 sec
- ( ) 14 sec

Question 5

1 / 1 pts

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

- Thermal conductivity = 0.12 W/m-K,
- Density = 510 kg/m3,
- Initial temperature = 20 ^oC,
- Specific heat = 1.3 J/g-K,
- d = 2 mm,
- Minimum ignition surface temperature = 400 ^oC,
- Exposed heat flux = 15kW/m^2

- 40 sec
- 22 sec
- 68 sec
- 14 sec

Quiz Score: **9** out of 9

HW7_after burning rate 2

Due Nov 9 at 1:59pm **Points** 9 **Questions** 5 **Time Limit** None
Allowed Attempts 3

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	6,013 minutes	9 out of 9

ⓘ Correct answers are hidden.

Score for this attempt: **9** out of 9
Submitted Nov 9 at 12:18am
This attempt took 6,013 minutes.

Question 1 — 5 / 5 pts

From the experiment in the lab that we conducted, the following data were obtained. What is the maximum flame spread rate in 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	7.2	9.2	10.8	12.8	14.8	16.4	18.4

12.5

Question 2

1 / 1 pts

The bottom half of a vertically oriented 0.4 m long, 0.1 m wide, 2 mm thick plywood (thermally thick) was exposed to heat flux of 60 kW/m2. It was ignited at 5 s. The 60 kW/m2 heat source was removed after ignition and uniform heat flux of 20 kW/m2 was applied to the surface from a 0.3 m tall flame from the bottom of the plywood. Calculate the upward fire spread rate with the following properties.

Density = 540 kg/m3, thermal conductivity = 0.12 W/m-K, specific heat = 2.5 kJ/kg-K. Initial temperature = 20 ^{o}C with total radiative and convective heat transfer coefficient is 20 W/m2-K. Ts=120 ^{o}C.

- 9 mm/s
- 4 mm/s
- 2 mm/s
- 7 mm/s

Question 3

1 / 1 pts

A 100 gallon of heptane is suddenly released from a storage tank to a 1.6 m by 2 m dike. Calculate the fuel burning rate in kg/s from the dike. Below are the heptane properties.

- 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]

- 0.09

- 0.29
- 0.23
- 0.07

Question 4

1 / 1 pts

A 100 gallon of heptane is suddenly released from a storage tank to a 1.6 m by 2 m dike. Calculate the total burning period in seconds from the dike. Below are the heptane properties.

- 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]

- 3550
- 890
- 3250
- 960

Question 5

1 / 1 pts

A 100 gallon of heptane is suddenly released from a storage tank to a 1.6 m by 2 m dike. Calculate the heat release rate in kW from the dike. Below are the heptane properties.

- Heat of combustion of heptane = 44.6 [kJ/g]

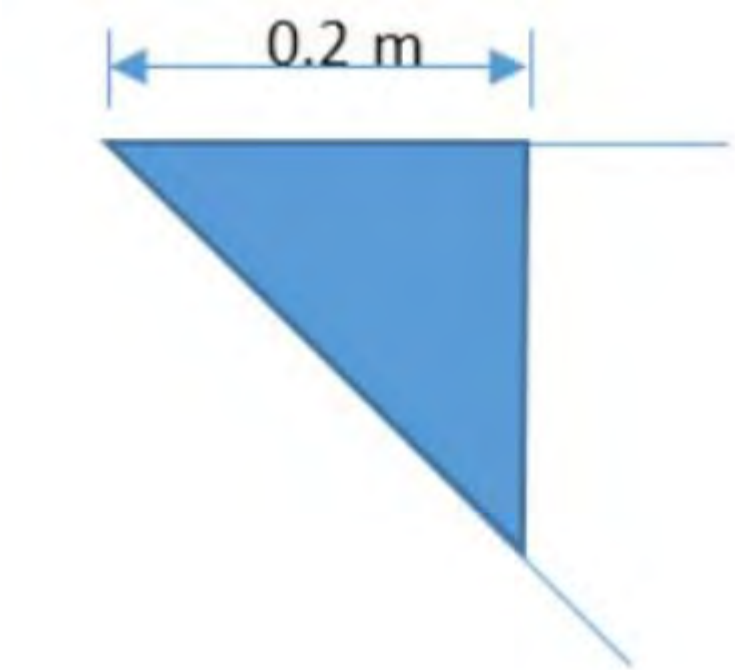
- Mass burning rate per unit area for infinite diameter = 0.101 [kg/m2-s]
- Extinction coefficient multiplied by the mean beam length corrector = 1.1 [1/m]
- Density = 675 [kg/m3]

- 3960
- 12820
- 3200
- 12630

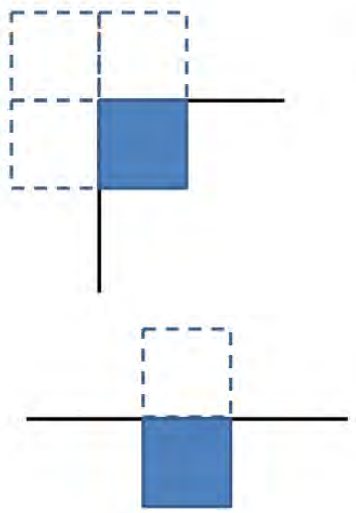
Quiz Score: **9** out of 9

Q1

Estimate the mass entrainment rate in kg/s at z = 2.3 m using the Zukoski axisymmetric plume correlation ($\dot{m}_p = 0.071 \cdot \left(\dot{Q}_c\right)^{\frac{1}{3}} (z)^{\frac{5}{3}}$) for the fuel base located in the **corner** of a room as shown below. Note that the convective heat release rate is 104 kW for the given wedge shape fuel surface area (with a 45o angle). Round your answer to the second decimal place without any unit.



Plume in the corner and against a wall



Using Zukoski plume ($\dot{m}_p = 0.071\dot{Q}^{1/3}z^{5/3}$),

– In the corner,

$$\dot{m}_{p,corner} \approx \frac{1}{4}(0.071(4\dot{Q})^{1/3}z^{5/3})$$
$$\approx 0.028\dot{Q}^{1/3}z^{5/3}$$

– Against the wall,

$$\dot{m}_{p,wall} \approx \frac{1}{2}(0.071(2\dot{Q})^{1/3}z^{5/3})$$
$$\approx 0.045\dot{Q}^{1/3}z^{5/3}$$

$$\dot{m}_{p,\text{ corner}} \approx \frac{1}{8}\left(0.071\,(8\dot{Q})^{1/3}z^{5/3}\right)$$

$$= \frac{1}{8} \times 0.071 \times (8 \times 104)^{\frac{1}{3}} \times 2.3^{\frac{5}{3}} = 0.33452$$

Q2&3

Calculate the plume centerline temperature and plume centerline velocity in Kelvin at 3.5 m above the fuel base for the following condition using the Heskestad's plume correlation. Write down your answer rounded to the nearest tens without units.

- Heptane fire in a circular pan having a 0.5 m diameter
- 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]
- Convective fraction of HRR = 0.7
- Ambient temp. = 20 C

$$\dot{Q} = \dot{m}''_{\infty}(1 - \mathrm{e}^{-k\beta D})\left(\frac{\pi}{4}D^2\right)(\Delta H_c)$$

$$= 0.101 \times (1 - e^{-1.1 \times 0.5}) \times \frac{\pi}{4} \times 0.5^2 \times 44.6 \times 10^3 = 374.178$$

$$\dot{Q}_c = \dot{m}''_{\infty}(1 - \mathrm{e}^{-k\beta D})\left(\frac{\pi}{4}D^2\right)(\Delta H_c) \times F_c$$

$$= 374.178 \times 0.7 = 261.925$$

$$z_o = 0.083 \times \dot{Q}^{\frac{2}{5}} - 1.02 \times D$$

$$z_o = 0.083 \times 374.178^{\frac{2}{5}} - 1.02 \times 0.5 = 0.377788$$

$$T_p = T_a + 25 \times \left(\frac{\dot{Q}_c^{\frac{2}{5}}}{z - z_o}\right)^{\frac{5}{3}} = 20 + 273.15 + 25 \times \left(\frac{261.925^{\frac{2}{5}}}{3.5 - 0.38}\right)^{\frac{5}{3}} = 446.777\,[K]$$

$$u_p = 1.0 \times \left(\frac{\dot{Q}_c}{z - z_o}\right)^{\frac{1}{3}} = \left(\frac{261.925}{3.5 - 0.38}\right)^{\frac{1}{3}} = 4.37866\,[m/s]$$

Q4

Calculate the maximum possible RTI [$m^{0.5}s^{0.5}$] of a sprinkler head to satisfy the following conditions. Round your answer to the nearest ones without units.

- Sprinkler activation temperature = 57°

- Sprinkler activation time less than 1 minute.
- Sprinkler is located 3 m away from the center of a 1 m diameter kerosene pool fire on a 6 m high ceiling.
- Ambient Temp. = 25 ◦C
- Kerosene's heat of combustion = 43.2 kJ/g
- Kerosene's mass burning rate per unit area for infinite diameter = 0.039 [kg/m2-s]
- Extinction coefficient multiplied by the mean beam length corrector = 3.5 [1/m]

$$t_r = \frac{RTI}{u^{0.5}} \ln\left(\frac{T_g - T_a}{T_g - T_d}\right)$$

$$RTI = \frac{t_r \cdot u^{0.5}}{\ln\left(\frac{T_g - T_a}{T_g - T_d}\right)}$$

$$For\ now,\ we\ have\ t_r = 60,\ T_a = 25,\ T_d = 57$$

$$So\ we\ should\ find\ u\ and\ T_g$$

$$In\ the\ given\ case,\ we\ have\ r = 3\ and\ H\ = 6$$

$$So,\ \frac{r}{H} = 0.5$$

$$For\ u\ and\ T_g,\ we\ have$$

$$T_g - T_\infty = \frac{5.38(\dot{Q}/r)^{2/3}}{H}\ and\ u = \frac{0.20\dot{Q}^{1/3}H^{1/2}}{r^{5/6}}$$

$$So\ we\ should\ find\ \dot{Q}$$

$$\dot{Q} = \dot{m}''_\infty (1 - \mathrm{e}^{-k\beta D})\left(\frac{\pi}{4}D^2\right)(\Delta H_c)$$

$$\dot{Q} = 0.039 \times (1 - e^{-3.5\times 1}) \times \frac{\pi}{4} \times 1^2 \times 43.2 \times 10^3 = 1283.28$$

$$T_g = 25 + \frac{5.38 \times \frac{1283.28}{3}^{\frac{2}{3}}}{6} = 75.9055$$

$$u = \frac{0.2 \times 1283.28^{\frac{1}{3}} \times 6^{0.5}}{3^{\frac{5}{6}}} = 2.13114$$

$$RTI = \frac{t_r \cdot u^{0.5}}{\ln\left(\frac{T_g - T_a}{T_g - T_d}\right)} = \frac{60 \times 2.13144^{0.5}}{\ln\left(\frac{75.9055 - 25}{75.9055 - 57}\right)} = 88.4352$$

HW9_after compartment fire due before the final

Due Dec 12 at 1:59pm **Points** 6 **Questions** 6
Available until Dec 12 at 1:59pm **Time Limit** None **Allowed Attempts** 3

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	3,007 minutes	6 out of 6

Correct answers are hidden.

Score for this attempt: **6** out of 6
Submitted Dec 11 at 4:51pm
This attempt took 3,007 minutes.

Question 1 1 / 1 pts

Calculate the heat release rate [MW] of a fire burning in a compartment where the equivalence ratio is larger than 1. Assume the following values. Write down your answer rounded to the first decimal place without units.

- Total fuel amount in a room = 10 kg
- Average heat of combustion of the fuel = 20 kJ/g
- Opening size: a single 2.4 m wide and 0.9 m tall opening
- The amount of air flow rate into the room = 400 g/s

1.2

Question 2

1 / 1 pts

Calculate the time [in sec] at which HRR becomes 100 kW for a t-squared fire with the fast growth rate. Write down your answer rounded to the nearest ones without any units.

- (●) 46
- ( ) 44
- ( ) 42
- ( ) 48

Question 3

1 / 1 pts

Calculate the upper layer temperature of a room (3.6 m by 2.4 m by 2.4m (H)) at 100 sec. The fire size is 700 kW and the room has a 2.1 m high and 0.9 m wide opening. The wall consists of 0.016 m thick gypsum boards and wood studs. The properties of the gypsum board are as below.

- Thermal conductivity = 0.48 W/m-K
- Density = 1440 kg/m3
- Specific heat = 0.84 kJ/kg-K

- (●) 258
- ( ) 254
- ( ) 351
- ( ) 346

Question 4

1 / 1 pts

What would be the heat release rate [kW] at flashover in a compartment (3.6 m(W) × 4 m (L) × 3 m (H)) that has a 2.4 m^2 opening area having the height of 0.9 m. Use the correlation from Thomas. Write your answer rounded to the nearest ones without units.

- (●) 1422
- ( ) 1441
- ( ) 1505
- ( ) 1480

Question 5

1 / 1 pts

Calculate the maximum possible heat release rate within a compartment (4.5 m wide, 6 m long, and 3.6 m high) and a 1.2 m wide and 1.2 m high wall opening assuming an oxygen-deficient condition.. Round your answers to the nearest ones without any units.

2,366

Question 6

1 / 1 pts

For a 100 kW fire with CH4 (heat of combustion = 50 kJ/g), what would be the soot generation rate in g/s if soot yield is 0.02? Round your answer to the second decimal place without any units.

0.04

Quiz Score: **6** out of 6