

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

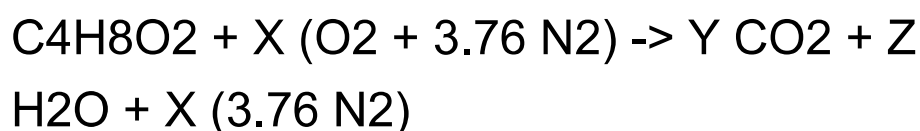
Submitted Oct 1 at 10:58pm

This attempt took 99 minutes.

Question 1

3 / 3 pts

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



Correct!

5

Correct 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: $x\text{O}_2 + 2.75\text{N}_2$

Correct!

0.73

Correct Answer

0.73 margin of error +/- 0.01

Question 3

3 / 3 pts

Calculate the heat of combustion of C_3H_8 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: $\text{C}_3\text{H}_8 = -103.8$ kJ/mole, $\text{CO}_2 = -393.5$ kJ/mole, $\text{H}_2\text{O} = -241.8$ kJ/mole

Correct!

2,043.9

Correct Answers

2,043.9 (with margin: 1)

Question 4

0 / 3 pts

Calculate the heat of combustion of C_2H_4 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: $C_2H_4 = 52.5$ kJ/mole, $CO_2 = -393.5$ kJ/mole, $H_2O = -241.8$ kJ/mole

You Answered

1,323.1

Correct 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,

- $V = 8 \text{ L}$,
- $R = 8.314 \text{ J/mole-K}$,
- $T = 605 \text{ K}$.

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/m³ at 20°C. Round your answer to the first decimal place and do not include any units.

Correct!**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/m³
- Opening height: 2.1 m from the floor
- Neutral plane height: 41% of the opening height

- Compartment upper layer temperature is 280 °C

You Answered

3.6

Correct 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

You Answered

622

Correct Answer

602 margin of error +/- 1%

Question 13

3 / 3 pts

Calculate adiabatic flame temperature (K) of Butane(C_4H_{10}) 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: $CO_2 = 54.3 \text{ J/mole-K}$, $H_2O = 41.3 \text{ J/mole-K}$, $N_2 = 32.7 \text{ J/mole-K}$.
- Heat of formation: fuel = -124.7 kJ/mole , $CO_2 = -393.5 \text{ kJ/mole}$, $H_2O = -241.8 \text{ kJ/mole}$

Correct!

2,472

Correct 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 $1,111^\circ\text{C}$. 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!

Correct Answer

251 margin of error +/- 1

Question 15

3 / 3 pts

Assuming thermally thick behavior, 39 kW/m² 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

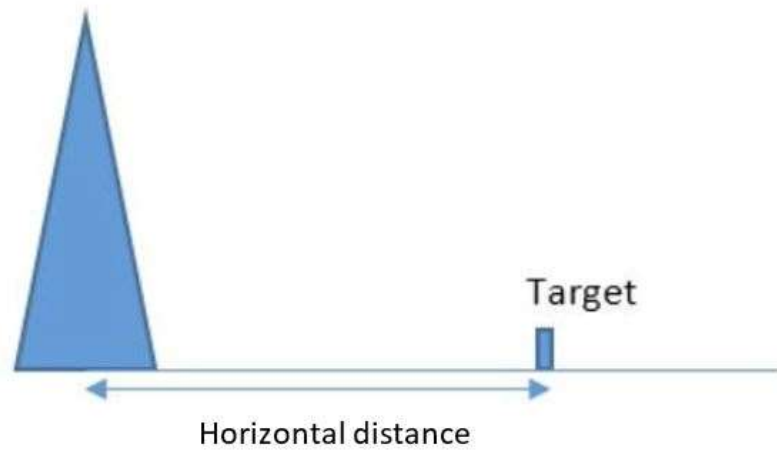
Correct Answer

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

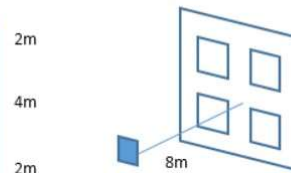
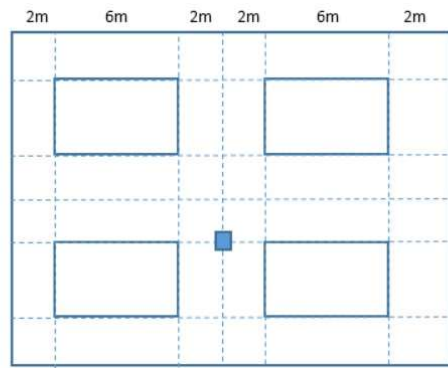
Correct Answer

8 margin of error +/- 0.2

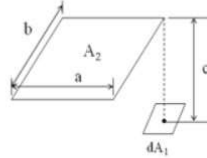
Question 17

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.

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

$$F_{dA_1 \rightarrow A_2} = \frac{1}{2\pi} \left(\frac{X}{\sqrt{1+X^2}} \tan^{-1} \frac{Y}{\sqrt{1+X^2}} + \frac{Y}{\sqrt{1+X^2}} + \frac{Y}{\sqrt{1+Y^2}} \tan^{-1} \frac{X}{\sqrt{1+Y^2}} \right)$$

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

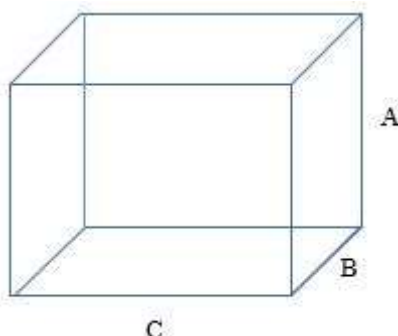
19 (with margin: 0)

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



Answered

0.21

Correct 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

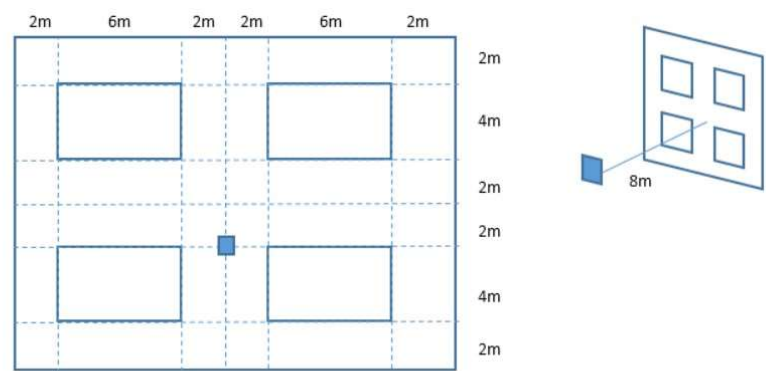
☐ 26

☐ 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.A-48)

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

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

$$F_{A_2} = \frac{1}{2\pi} \left(\frac{X}{\sqrt{1+X^2}} \tan^{-1} \frac{Y}{\sqrt{1+X^2}} + \frac{Y}{\sqrt{1+Y^2}} \tan^{-1} \frac{X}{\sqrt{1+Y^2}} \right)$$

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