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Courses » Micro and nano scale energy transport

Announcements Course Forum Progress Mentor

## Unit 12 - Week 11

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### Week 11 Assignment 1

The due date for submitting this assignment has passed.

**Due on 2017-10-16, 00:00 IST.**

#### Submitted assignment

Answer the following questions. More than one option can be correct.

1) Microchannels are directly etched into silicon chips to dissipate a heat flux of from a computer chip. Each of the **1 point** parallel microchannels has a width  $a = 200 \mu\text{m}$ , height  $b = 200 \mu\text{m}$ , and length  $L = 10 \text{ mm}$ . Refrigerant R-123 flows through the microchannels. Calculate the heat transfer coefficient for if Nusselt number for fully developed flow is 3.556.

Properties of R-123

$$\mu_L = 404.2 * 10^{-6} \text{Ns/m}^2, \mu_V = 10.8 * 10^{-6} \text{Ns/m}^2, \rho_L = 1456.6 \text{kg/m}^3, \rho_V = 6.5 \text{kg/m}^3, C_{p,L} = 1023 \text{J/KgK}, K_L = 75.6 * 10^{-3} \text{W}$$

- 1426
- 1344
- 1444
- 13444

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

1344

2) With the data from previous questions, Calculate the mass flux if the reynolds number is 100. (in Kg/S) **1 point**

- 0.202
- 202
- 402
- 302

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

202

3) With the data from previous questions, calculate the single phase pressure drop in the microchannel (Pa) **1 point**

- 253
- 353
- 0.353
- 453

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

353

4) With the data in previous questions, calculate the total pressure drop if the boiling in microchannel starts at 8.29mm and the two phase pressure drop is 42,858 Pa/m **1 point**

- 526
- 326
- 426
- 0.426

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

426

5) If the heat flux needed to be dissipated is  $13000 \text{W/m}^2$  for the microchannel system described in previous question. Calculate the bond number. **1 point**

- 
- $0.378 * 10^{-3}$
- 
- $0.178 * 10^{-3}$
- 
- $0.478 * 10^{-3}$
-

0.0378 \* 10<sup>-3</sup>

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.378 \* 10<sup>-3</sup>

6) Calculate the heat transfer coefficient considering nucleate boiling regime from the data in the previous problems for the vapor quality **1 point** of 0.5. Consider  $F_{Fl} = 1$ .

- 3169.58  
 1269.28  
 416.985  
 4169.58

No, the answer is incorrect.

Score: 0

Accepted Answers:

4169.58

7) The stability of nano fluids is determined by **1 point**

- Delta potential  
 Zeta potential  
 Alpha potential  
 Ph value of mixture

No, the answer is incorrect.

Score: 0

Accepted Answers:

Zeta potential

8) Advantage of nano fluids over conventional slurries **1 point**

- No erosion  
 Less fouling  
 No clogging  
 Sedimentation

No, the answer is incorrect.

Score: 0

Accepted Answers:

Less fouling

No clogging

No erosion

9) The properties of base fluid and nano fluid particles are respectively **1 point**

(Water : Density( $\rho$ ) = 995.7kg/m<sup>3</sup>, Specificheat( $C_p$ ) = 4.178 \* 10<sup>3</sup>J/KgK, Thermalconductivity( $k$ ) = 0.615W/Km, Viscosity( $\mu$ )

(MWCNTnanoparticles : Density( $\rho$ ) = 2000kg/m<sup>3</sup>, Specificheat( $C_p$ ) = 710J/KgK, Thermalconductivity( $k$ ) = 2800W/Km)

Calculate the density of the nanofluid at 1% volume fraction of nano particle

- 1005.743  
 1150.43  
 990.75  
 1240.65

No, the answer is incorrect.

Score: 0

Accepted Answers:

1005.743

10) With the properties from question 9 calculate the specific heat of 1% volume fraction nanofluid **1 point**

- 4109.03  
 2000  
 4183  
 410.903

No, the answer is incorrect.

Score: 0

Accepted Answers:

4109.03

11) With the data from Question 9, Calculate the thermal conductivity using the maxwells model. **1 point**

- 0.6336  
 63.36  
 0.5  
 10

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.6336

12) Calculate the effective thermal conductivity using the data provided in question 9 using hamiltonian crosser model considering sphericity( $\psi$ ) as 0.5. **1 point**

- 0.05785

- 0.613
- 0.5785
- 5.785

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.5785

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