ermal Sciences Final Exam

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Q3) In an ideal Rankine cycle, water leaves the boiler as saturated vapor at 90 C and it leaves the turbine with 90 % quality. If the condenser operates on 30 kPa pressure and the mass flow rate of the fluid is 1 kg/sec.

The efficiency of the cycle (%) is

- 15
- 25
- 45
- 35

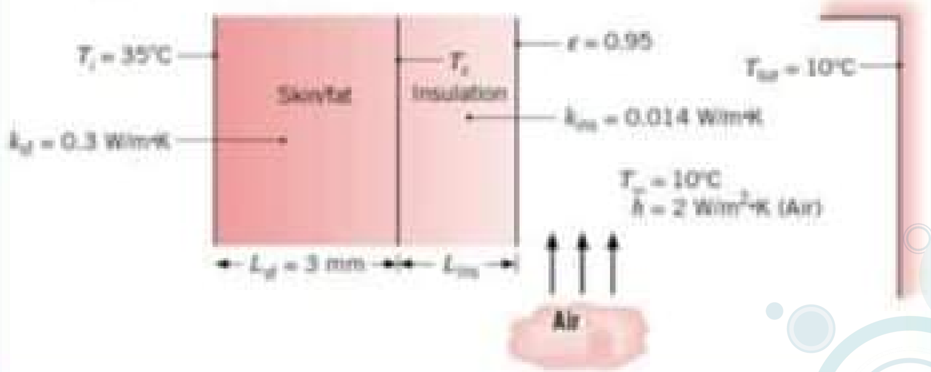
Change in entropy within condenser (kJ/k) is

- Zero
- Positive
- Negative
- None of the above

Time left 0:27:15

Question 10
Not yet answered
Marked out of 4.00
Flag question

In the figure below, the total heat loss from the skin is 100 W



The total thermal resistance value between T_i and (air and surroundings) in C/W is:

Answer:

Question 11
Not yet answered
Marked out of 4.00
Flag question

The value of T_s in C is:

Answer:

Question 12
Not yet answered
Marked out of 4.00
Flag question

The insulation thickness L_{ins} in mm is:

Answer:

l Sciences Final Exam × Thermal Sciences Final Exam ×

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Q2) One kg of saturated water at 120 C, is completely condensed at constant pressure. If the surrounding temperature is 30 C

The entropy changes of the system (kJ/K) is

- 5.6
- -6.5
- 6.5
- − 5.6

The net entropy change (kJ/K) is

- 1.9
- -9.1
- -1.9
- 9.1

The heat exchanged with surroundings (kJ) is nces Final Exam × | Thermal Sciences Final Exam ×

pQLSfCUMKzgG5B77P8ErB8yYA1DwEQ1PNkYOxLF1zVjjZZ_q25NQ/formResponse

The heat exchanged with surroundings (kJ) is

- 2200
- 2430
- 2400
- 4200

The entropy change of the surrounding (kJ/K) is

- -5.7
- 5.7
- 7.5
- -7.5

التالي رجوع

Time left 0:44:16

Question 6

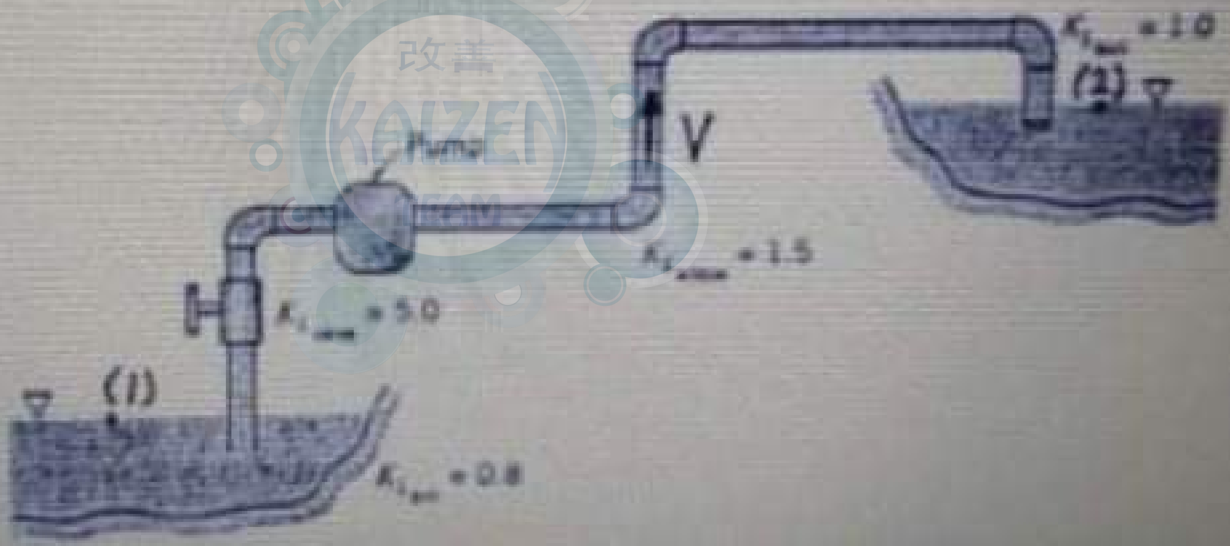
Not yet answered

Marked out of 4.00

Flag question

The pump shown in the figure below has a head of 250 m. The difference in the elevation is 200 m. Pipe length and dimeter are 500 m and 0.075 m respectively. Note: pipe is smooth (i.e. roughness is zero).

Assume water density 1000 kg/m^3 and dynamic viscosity is 1.792x 10^{-3} kg/m·s



The Re number value is:

Quiz nav

1 2

7 8

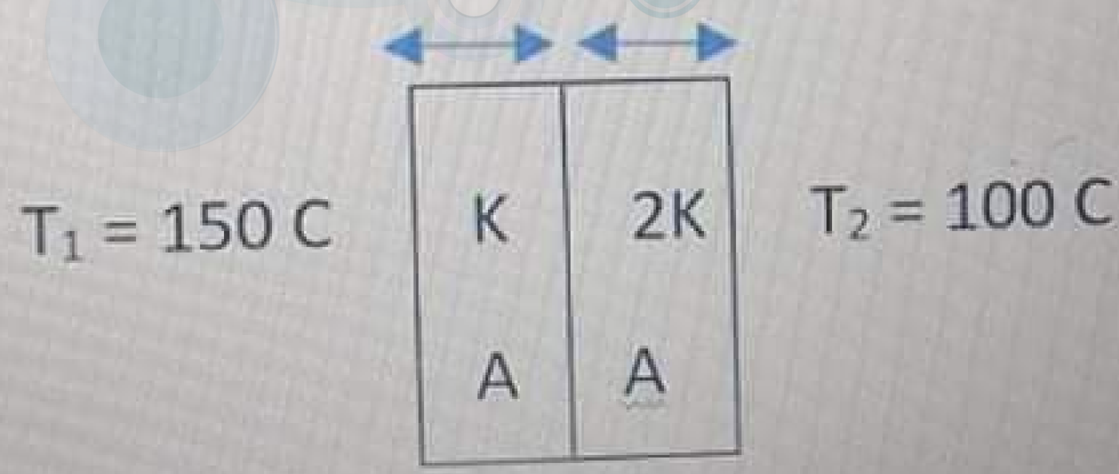
13 14

Finish attem

The inner and outer surfaces temperature of a furnace are 850 C and 250 C respectively. The wall is of thermal conductivity of 0.3 W/m.K and thickness of 50 cm. The thermal resistance (K/W) is

- 2.667 ○
- 1.667 ○
- 3.667 ○
- 0.667 ○

?In the shown composite wall, the junction is 150 C the ratio of wall thickness



- 1:2 ○

EXAMPLE 18–1 **Temperature Measurement by Thermocouples**

The temperature of a gas stream is to be measured by a thermocouple whose junction can be approximated as a 1-mm-diameter sphere, as shown in Fig. 18–9. The properties of the junction are $k = 35$ W/m·K, $\rho = 8500$ kg/m^3, and $c_p = 320$ J/kg·K, and the convection heat transfer coefficient between the junction and the gas is $h = 210$ W/m^2·K. Determine how long it will take for the thermocouple to read 99 percent of the initial temperature difference.

SOLUTION The temperature of a gas stream is to be measured by a thermocouple. The time it takes to register 99 percent of the initial ΔT is to be determined.

Assumptions **1** The junction is spherical in shape with a diameter of $D = 0.001$ m. **2** The thermal properties of the junction and the heat transfer coefficient are constant. **3** Radiation effects are negligible.

Properties The properties of the junction are given in the problem statement.

Analysis The characteristic length of the junction is

$$L_c = \frac{V}{A_s} = \frac{\frac{1}{6}\pi D^3}{\pi D^2} = \frac{1}{6}D = \frac{1}{6}(0.001 \text{ m}) = 1.67 \times 10^{-4} \text{ m}$$

Then the Biot number becomes

Final Exam × +

SfCUMKzgG5B77P8ErB8yYA1DwEQ1PNkYOxLF1zVjjZZ_q25NQ/formResponse

The heat added to fluid within boiler [kW] is

- -4220
- 2110
- 4220
- -2110

The power produced by the turbine [kW] is

- 603
- 1306
- 306
- 1603

Power required by the pump (kW) is

- 172.0
- 1.72

mal Sciences Final Exam × | Thermal Sciences Final Exam × | +

/e/1FAIpQLSfCUMKzgG5B77P8ErB8yYA1DwEQ1PNkYOxLF1zVjjZZ_q25NQ/formResponse

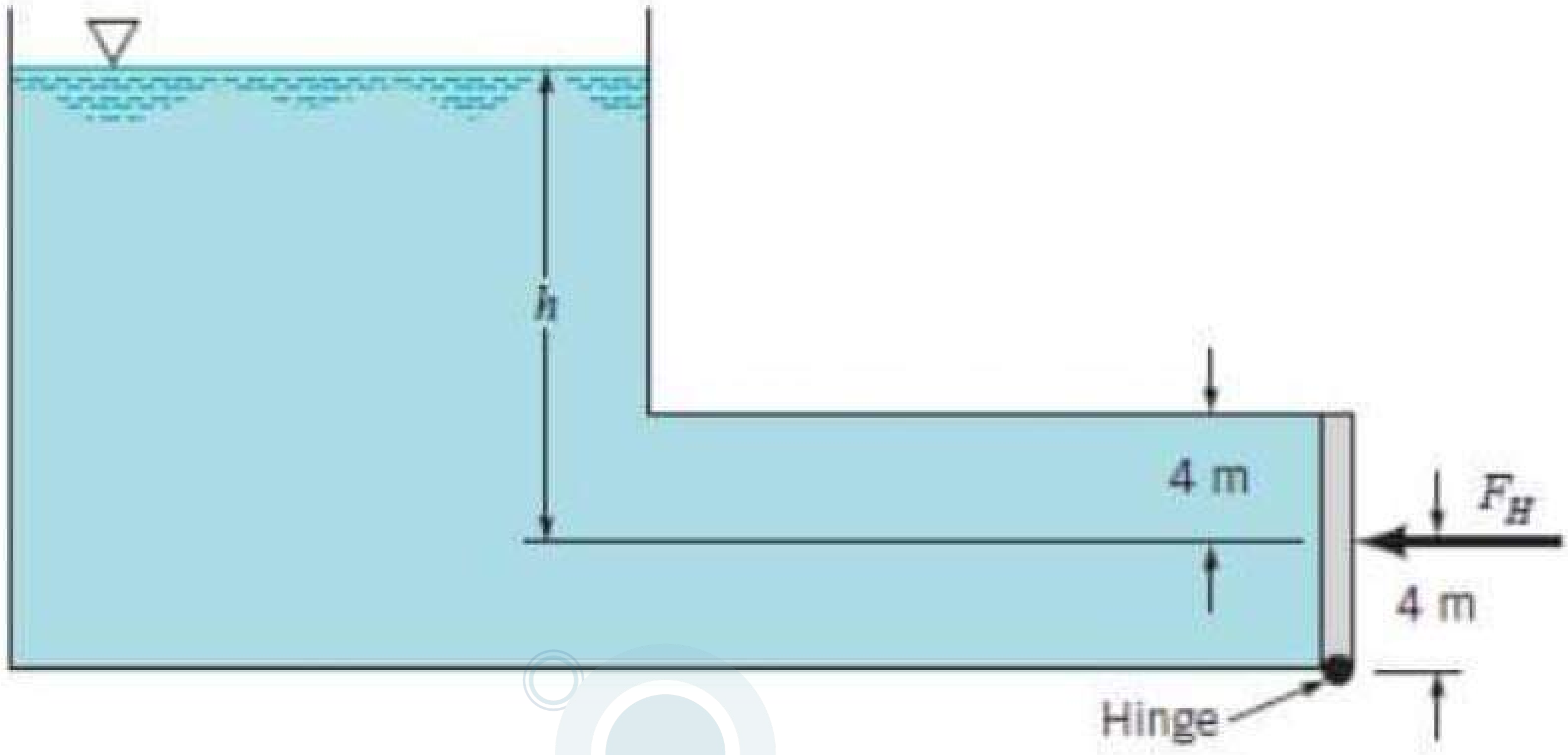
A wall of thickness 0.6 m and k = 17.45 W/m K. if the first face is subjected to radiant heat at a rate of 530.5 watt/m2 while the second face is kept at of 38C, The temperature of the first face (C)is

- 32
- 32.87
- 87.5
- 47.08

The ratio of the conducted heat through two walls of the same thickness and cross sectional with one wall of thermal conductivity equals to half of the other one is

- 1/2
- 4
- 2
- 1

A 3-m-wide, 8-m-high rectangular gate is located at the end of a rectangular passage that is connected to a large open tank filled with water as shown in Figure. The gate is hinged at its bottom and held closed by a horizontal force, F_H, located at the center of the gate. The water depth, h, above the center of the gate, when the water depth, h is 15 m. Note that the density of water: = 999 kg/



) The hydrostatic pressure force on the gate is:

a. 3528 kN
b. 1764 kN
c. 147 kN
d. 3214 kN
e. None of the above

) The center of pressure measured from the free surface of the water along the plane of the gate is:

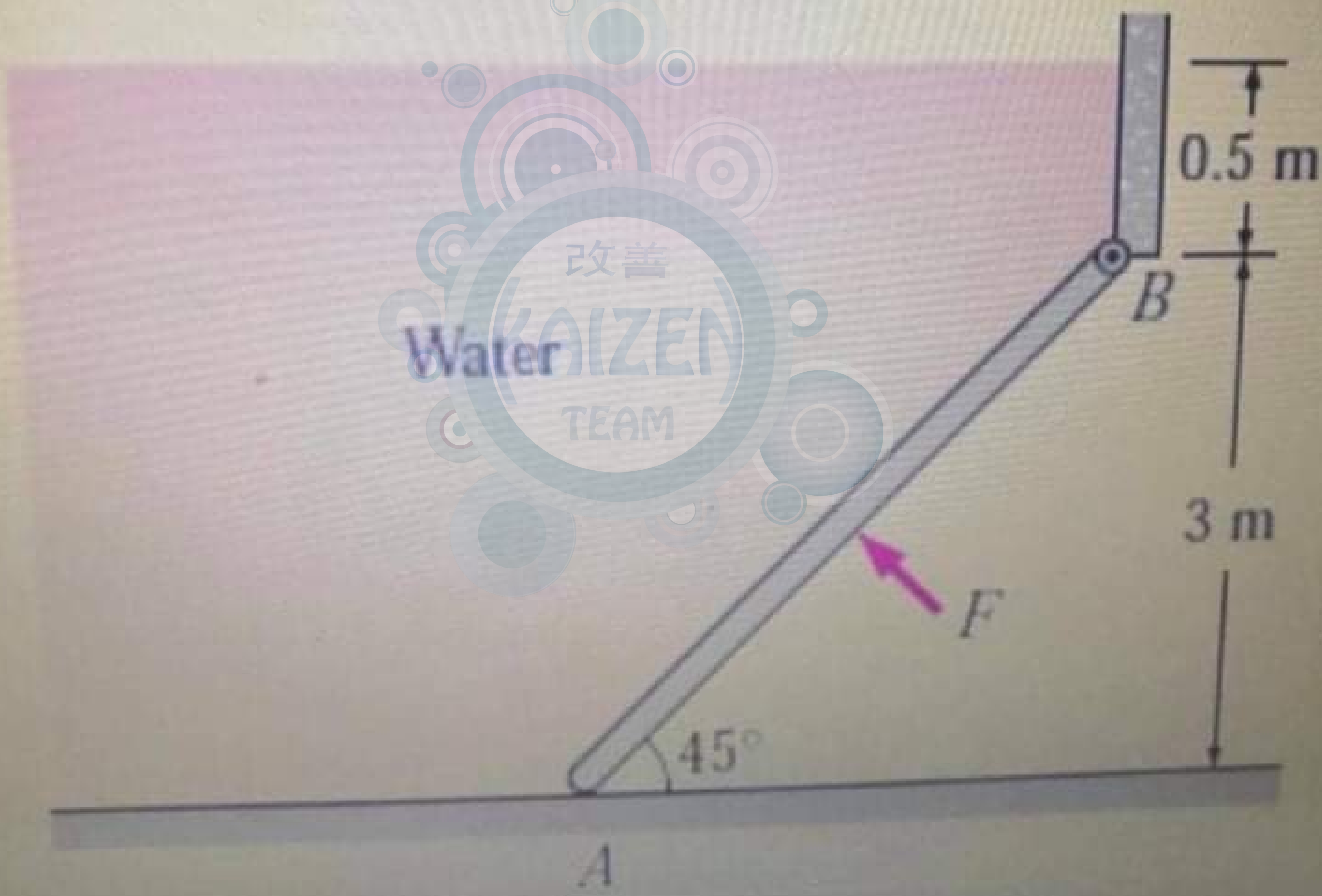
a. 7.86 m
b. 15.36 m
c. 5.33 m
d. 16.75 m
e. None of the above

) The minimum force F_H when the gate start to open is:

a. 3528 kN
b. 1764 kN
c. 147 kN
d. 3214 kN
e. None of the above

Q(2-4)

A 200-kg, 5-m-wide rectangular gate shown in the figure is hinged at B and leans against the floor at A making an angle of 45° with the horizontal. The gate is to be opened from its lower edge by applying a normal force at its center. Assume the density of the water is 1000 kg/m3. Answer Problems (2-4):



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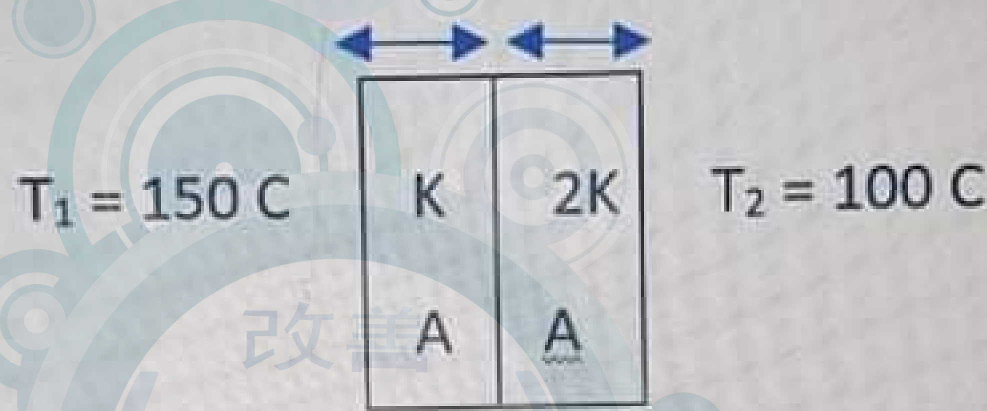
?In the shown composite wall, the junction is 150 C the ratio of wall thickness



- 1:2
- 2:1
- 2:3
- 1:1

A wall of thickness 0.6 m and k = 17.45 W/m K. if the first face is subjected to radiant heat at a rate of 530.5 watt/m2 while the second face is kept at of 38C. The temperature of the first face (C)is ciences Final Exam

AlpQLSfCUMKzgG5B77P8ErB8yYA1DwEQ1PNkYOxLF1zVjjZZ_q25NQ/formResponse

The change in the entropy of the steam within the turbine (kJ/K) is

- Zero
- Positive value
- Negative value
- None of the above

Change in entropy within the pump

- Zero
- Positive
- Negative
- None of the above

The heat added to fluid within boiler [kW] is

- -4220

Question 1

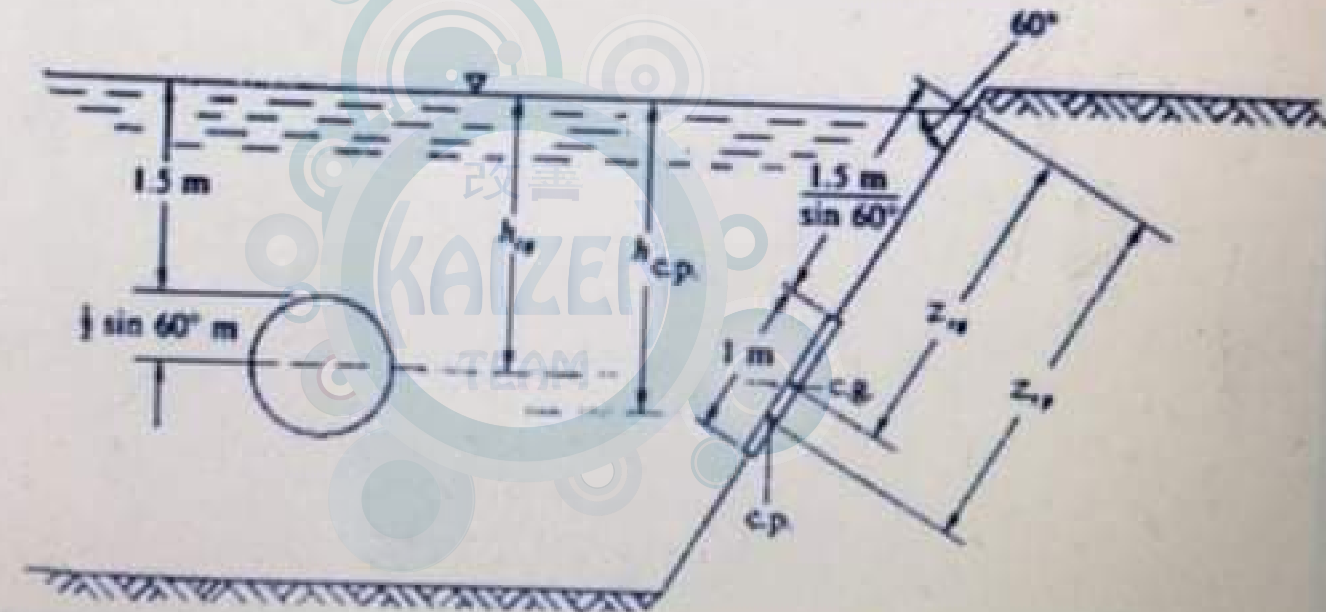
Not yet answered

Marked out of 4.00

Flag question

Time left 1:01:04

An inclined, cylindrical gate with water on one side is shown in figure, here c.p. represents the location of center of pressure. Assume water density 1000 kg/m^3.



The hydrostatic pressure force on the gate in kN is:

Quiz navigation

1

Finish attempt ...

الوقت المتبقي 0:57:02

The diagram below shows a horizontal nozzle discharging water into the atmosphere. Th
inlet has area =600 mm^2 and the outlet has area=200 mm^2. The inlet pressure is 400 kP
and the outlet pressure is zero. Assume water density 1000 kg/m^3.

The volume flow rate of water in the nozzle in m^3/s is:

الصفحة التالية

The water level in a tank is 20 m above the ground. A hose is connected to the bottom of the tank, and the nozzle at the end of the hose is pointed straight up. The tank cover is airtight, and the air pressure above the water surface is 2 atm gage. The system is at sea level. Note that (1 atm = 101.325 kPa) and the density of water = 1000 kg/m^3. The maximum height to which the water stream could rise is:

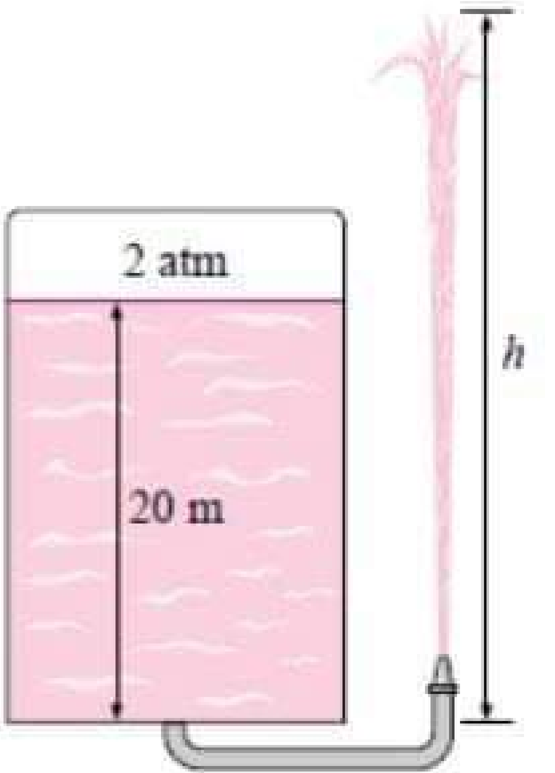
f. 30.3 m

g. 51.0 m

h. 40.7 m

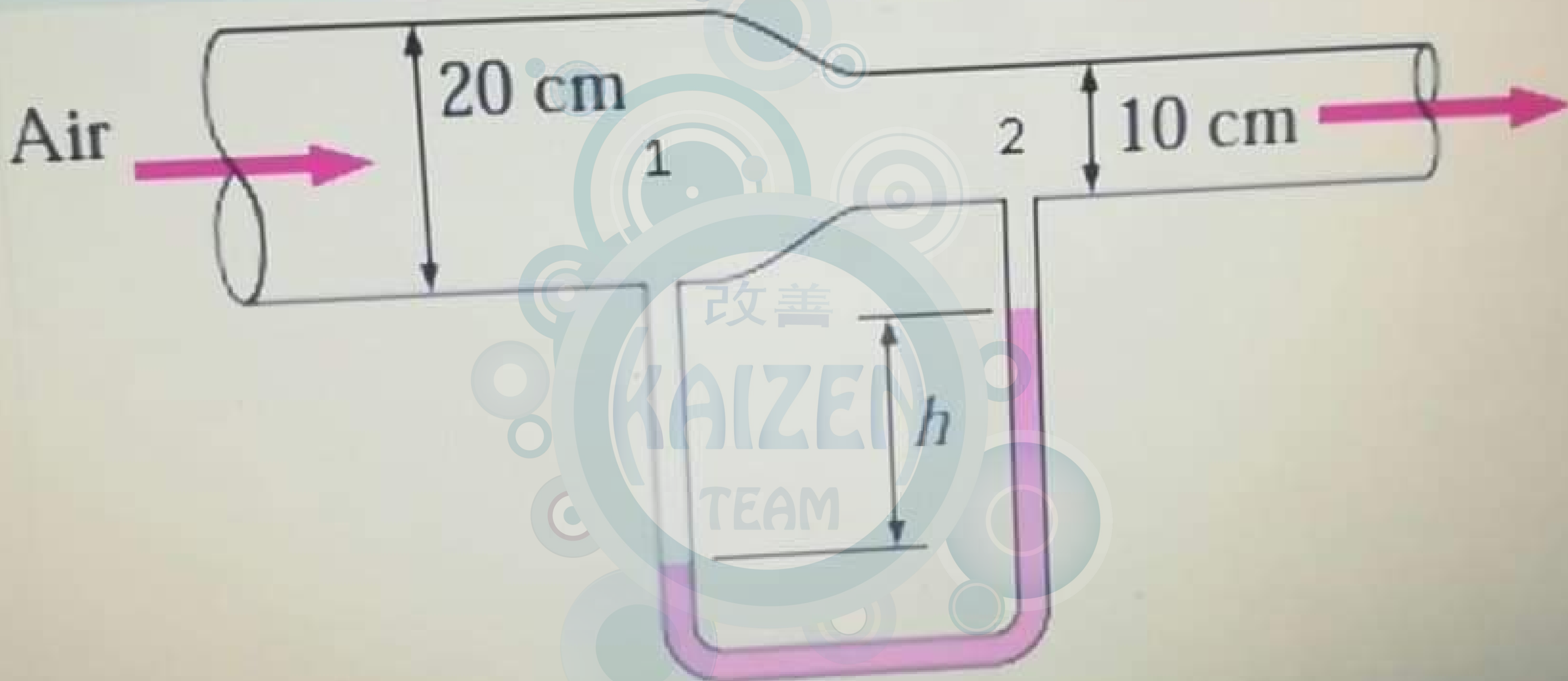
i. 31.0 m

j. None of the above



Q(8-9)

Air flows through a pipe at a rate of 0.3 m3/s. The pipe consists of two sections of diameters 20 cm and 10 cm with a smooth reducing section that connects them. The pressure difference between the two pipe sections is measured by a water manometer. Neglect the frictional effects and take the air density to be 1.20 kg/m3. Answer Problems (8-9):



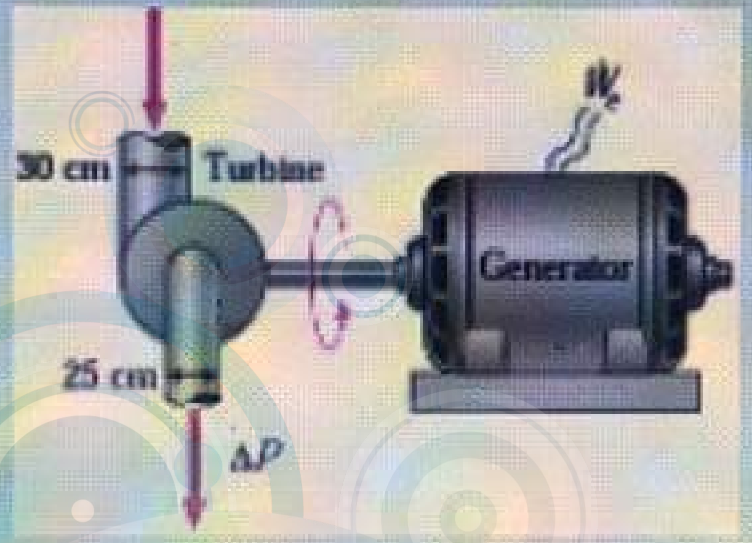
8

Question 2

Not yet answered

Marked out of 2.00

Flag question



Water with density 1000 kg/m^3 enters a hydraulic turbine through a 30-cm diameter pipe at a rate of 0.6 m^3/s and exits through a 25-cm diameter pipe. The pressure drop, ΔP, of water in the turbine is measured to be 200 kPa. Assume kinetic energy correction factor, α =1. For a combined turbine-generator efficiency of 80 percent. The velocity at the exit of the turbine is:

Select one:

- a. None of the above
- b. 38.3 m/s
- c. 6.1 m /s
- d. 8.49 m/s
- e. 12.2 m/s

Clear my choice

Test name: Quiz#2

Question 1/1

For the given system below, the flow rate is 1.25 m3/sec and the valve is half open. Find:

1. Re number and the flow type.
2. friction factor
3. the value of Z_2 in meters

10 cm diameter steel pipe

Threaded elbows

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1 ○

Lumped capacitance methods state that thermal conductivity is

- Infinitely small ○
- Moderate ○
- 50% small ○
- Infinitely large ○

The time required to cool a 2 mm diameter sphere is to be cooled from 500 to 60 C by exposing it to an environment at 25 C. Given the following (Density = 2250 kg/m3, Specific heat = 850 J/kg K, Conductivity = 1.5 W/m K). The time required to achieve this in seconds is

- 16.78 ○
- 15.78 ○
- 13.78 ○
- 14.78 ○

Question 4

Not yet answered

Marked out of 4.00

Flag question

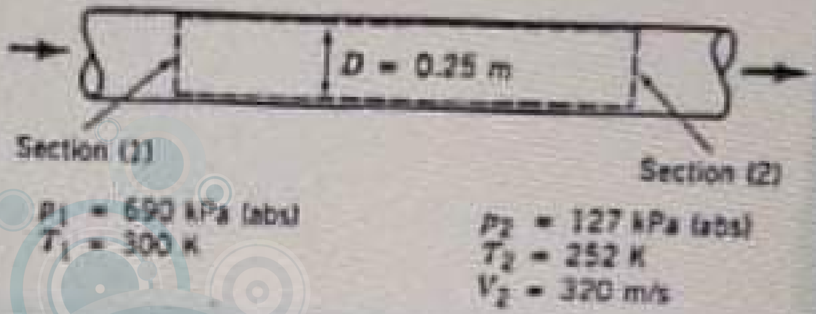
Time left 0:52:07

Quiz navigation

1 2 3 7 8 9 13 14

Finish attempt

Air flow in the pipe shown below with the described information.



The inlet velocity in m/s is:

Answer:

Question 5

Not yet answered

Marked out of 2.00

Flag question

The air density at the exit in kg/m³ is:

Answer:

ermal Sciences Final Exam

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603

1306

306

1603

Power required by the pump (kW) is

172.0

1.72

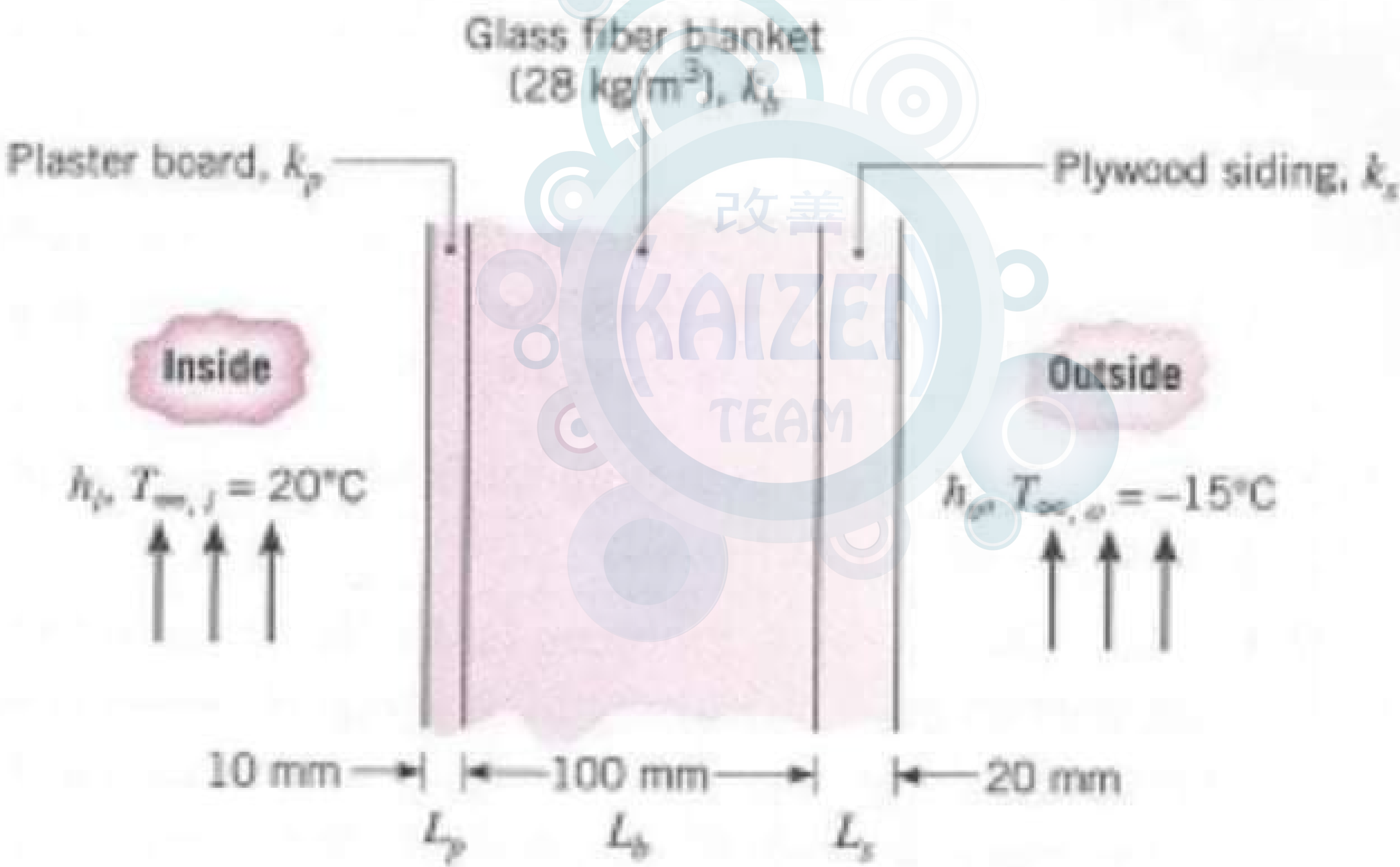
0.172

17.2

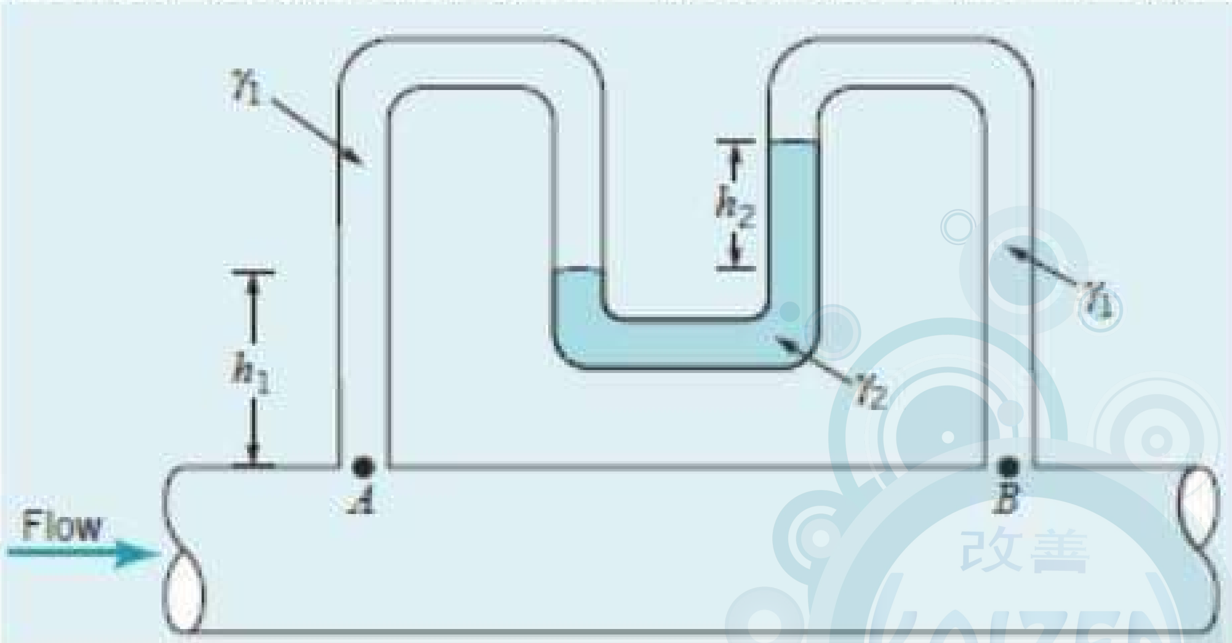
إرسال

رجوع

3.13 A house has a composite wall of wood, fiberglass insulation, and plaster board, as indicated in the sketch. On a cold winter day, the convection heat transfer coefficients are $h_o = 60\ \mathrm{W/m^2 \cdot K}$ and $h_i = 30\ \mathrm{W/m^2 \cdot K}$. The total wall surface area is $350\ \mathrm{m^2}$.



) A manometer is attached to a pipe as shown. The specific weight of the flowing fluid ,, the specific weight of the gage fluid ,, and the various heights shown. For, , and . Note that. The value of the pressure drop, is:



a. 4.35 kPa

b. 2.90 kPa

c. 5.80 kPa

d. 8.70 kPa

e. None of the above

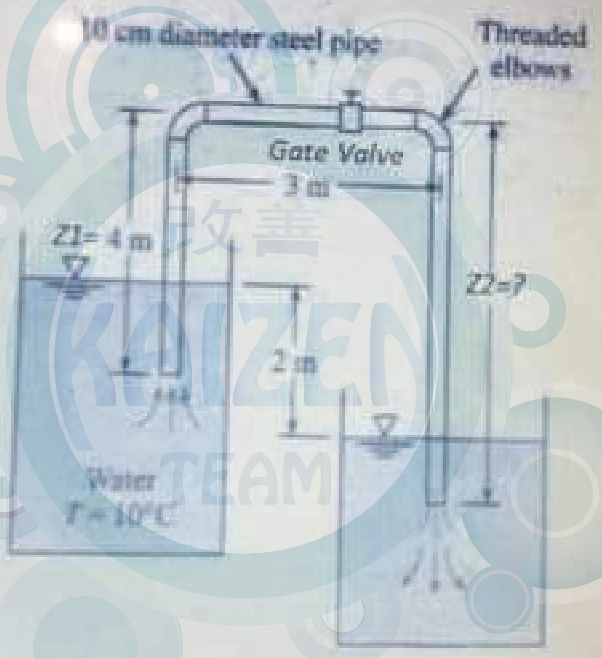
$$p_A - \gamma_1 h_1 - \gamma_2 h_2 + \gamma_1 (h_1 + h_2) = p_B$$

or

$$p_A - p_B = h_2(\gamma_2 - \gamma_1)$$

$$p_A - p_B = (0.5\text{ m})(15.6\text{ kN/m}^3 - 9.80\text{ kN/m}^3)$$
$$= 2.90\text{ kPa}$$

2. friction factor
3. the value of Z_2 in meters



Question **20**

Not yet answered

Marked out of 2.00

Flag question

The rate of convection heat transfer from one steel ball (rounded to two decimal digits) at the end of the process in W is:

Answer:

Question 13

Not yet answered

Marked out of 1.00

Flag question

The thermal resistance of the wall material 2 (rounded to four decimal digits) in °C/W is:

Answer:

Question 14

Not yet answered

Marked out of 1.00

Flag question

The thermal resistance of the wall material 3 (rounded to four decimal digits) in °C/W is:

Answer:

Question 15

Not yet answered

Marked out of 4.00

Flag question

The total thermal resistance value (rounded to four decimal digits) between the inside $T_{\infty,1}$ and outside $T_{\infty,2}$, in °C/W is:

Answer:

Question 16

Not yet answered

Marked out of 2.00

Flag question

The heat transfer rate across the wall (rounded to two decimal digits), in W is:

Answer:

Question 17

Not yet answered

Marked out of 2.00

Flag question

The temperature T_3 (rounded to two decimal digits) in °C is:

Answer:

Question 11

Not yet answered

Marked out of 2.00

Flag question

The shaft power required to run the pump (rounded to two decimal digits), in kW is:

Answer:

Question 8
Not yet answered
Marked out of 2.00
Flag question

The minor head losses (rounded to two decimal digits), in m is:

Answer:

Question 9
Not yet answered
Marked out of 3.00
Flag question

The pump head (rounded to two decimal digits), in m is:

Answer:

Question 10
Not yet answered
Marked out of 2.00
Flag question

The power added by the pump to the fluid (rounded to two decimal digits), in kW is:

Answer:

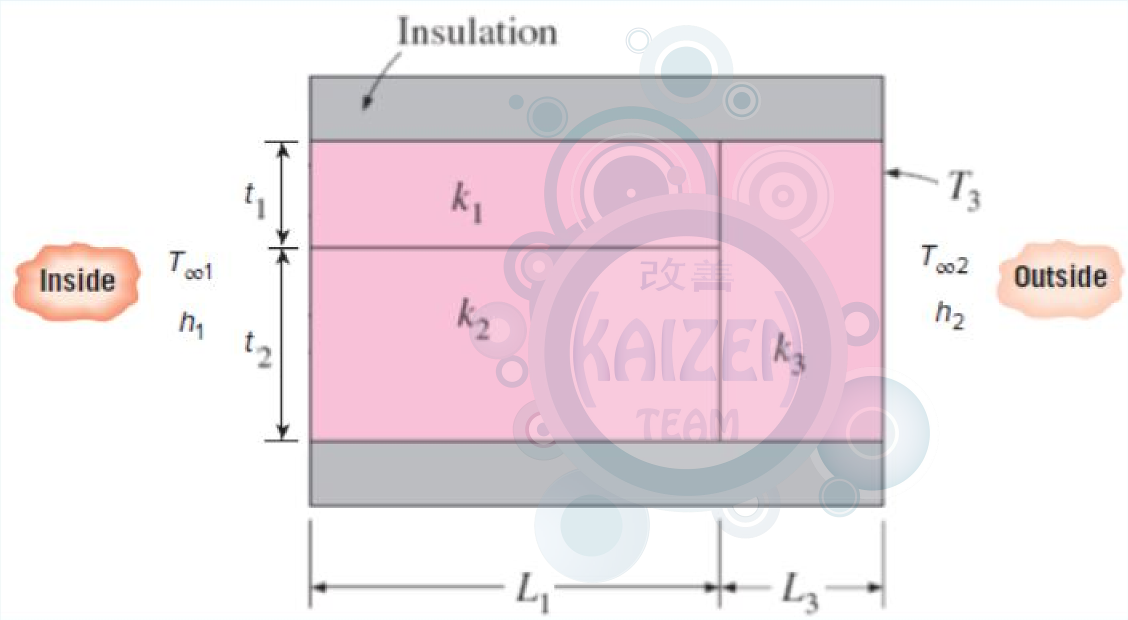
Question **12**

Not yet answered

Marked out of 1.00

Flag question

A plane wall is modeled as shown below consists of three materials $k_1 = 10$ W/m.K, $k_1 = 15$ W/m.K, and $k_3 = 20$ W/m.K, the inside has $h_1 = 30$ W/m^2.K and $T_1 = 20$ °C and the outside has (h_2=60 \) W/m^2.K and $T_2 = -10$ °C. The width of the wall is 1 m, the thicknesses $L_1 = 40$ cm and $L_3 = 20$ cm and heights $t_1 = 10$ cm and $t_2 = 50$ cm



The thermal resistance of the inside air (rounded to four decimal digits) in °C/W is:

Answer:

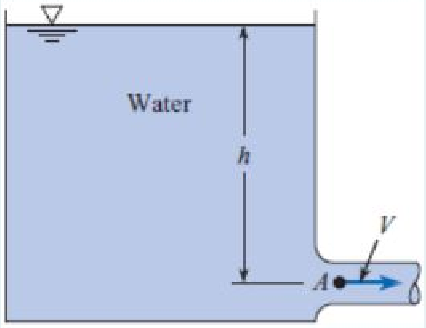
Question 5

Not yet answered

Marked out of 4.00

Flag question

The velocity in the outlet pipe from this reservoir is 10 m/s and h = 25 m. Assume negligible friction and viscous effects. Under these conditions. Assume the water density is 1000 kg/m^3.



The gage pressure at A (rounded to two decimal digits), in kPa is:

Answer:

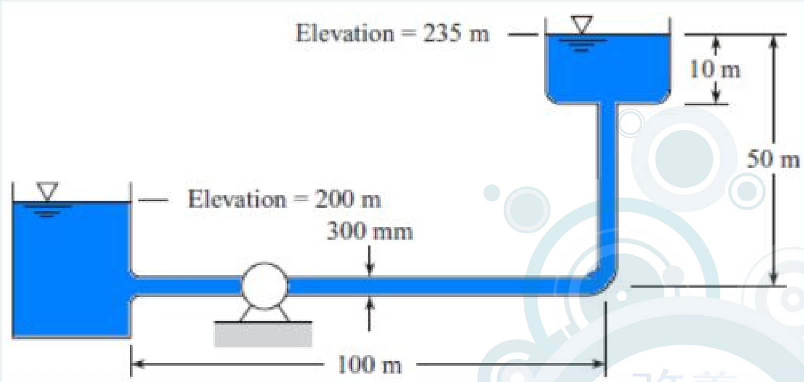
Question **6**

Not yet answered

Marked out of 2.00

Flag question

Water is pumped from the lower reservoir to the upper reservoir at a rate of 0.25 m^3/s. The inlet is slightly rounded $(r/D = 0.1)$, the exit is sharp-edged, the bend is smooth and flanged, the pipe is made of cast iron, and the pump efficiency is 80%. Assume the water density, ρ, is 1000 kg/m^3 and the dynamic viscosity, μ, of the water is 10^{-3} kg/m.s.



The Reynolds number value is:

Answer:

Question **7**

Not yet answered

Marked out of 3.00

Flag question

The major head losses (rounded to two decimal digits e.g. 1.24), in m is:

Answer:

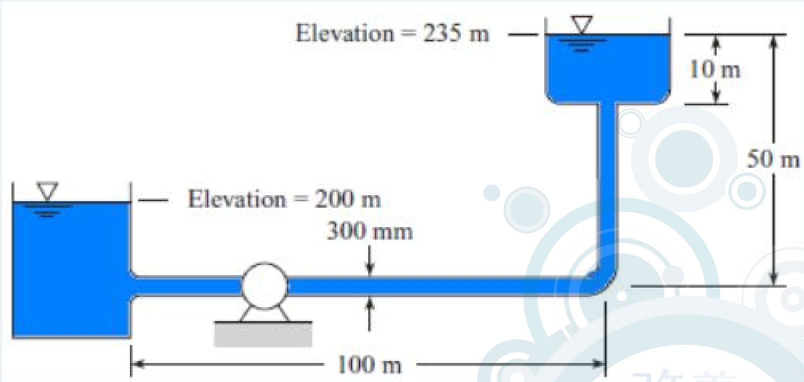
Question **6**

Not yet answered

Marked out of 2.00

Flag question

Water is pumped from the lower reservoir to the upper reservoir at a rate of 0.25 m^3/s. The inlet is slightly rounded $(r/D = 0.1)$, the exit is sharp-edged, the bend is smooth and flanged, the pipe is made of cast iron, and the pump efficiency is 80%. Assume the water density, ρ, is 1000 kg/m^3 and the dynamic viscosity, μ, of the water is 10^{-3} kg/m.s.



The Reynolds number value is:

Answer:

Question **7**

Not yet answered

Marked out of 3.00

Flag question

The major head losses (rounded to two decimal digits e.g. 1.24), in m is:

Answer:

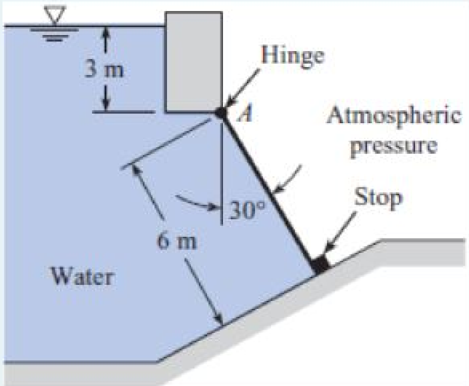
Question 3

Not yet answered

Marked out of 3.00

Flag question

The gate shown is circular with diameter 6 m. Let the weight of the gate be 100 kN. Assume the water density is 1000 kg/m^3.



The hydrostatic pressure force (rounded to two decimal digits), in kN is:

Answer:

Question 4

Not yet answered

Marked out of 5.00

Flag question

The reaction force at point A (rounded to two decimal digits), in kN is:

Answer:

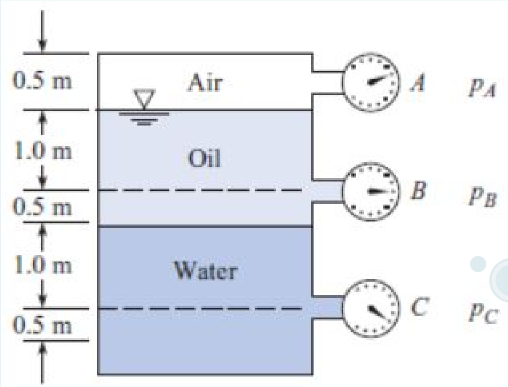
Question 1

Not yet answered

Marked out of 3.00

Flag question

For the closed tank with pressure gages readings of $P_A = 20$ kPa, and $P_B = 27.5$ kPa. Assume the water density is 1000 kg/m^3.



The specific gravity of the oil (rounded to three decimal digits e.g. 1.278), is:

Answer:

Question 2

Not yet answered

Marked out of 4.00

Flag question

The pressure reading on gage C (rounded to two decimal digits), in kPa is:

Answer:

Question 18

Not yet answered

Marked out of 2.00

Flag question

Steel balls 12 mm in diameter are annealed by heating to 1150 K and then slowly cooling to 400 K in an air environment for which $T_\infty = 325$ K and $h = 20$ W/m$^2\cdot$K. Assuming the properties of the steel to be $k = 40$ W/m$\cdot$K, $\rho = 7800$ kg/m^3, and $c = 600$ J/kg$\cdot$K

The time required for the cooling process in s is:

Answer:

Question 19

Not yet answered

Marked out of 2.00

Flag question

The total amount of heat transfer from one steel ball (rounded to two decimal digits) in J is:

Answer:

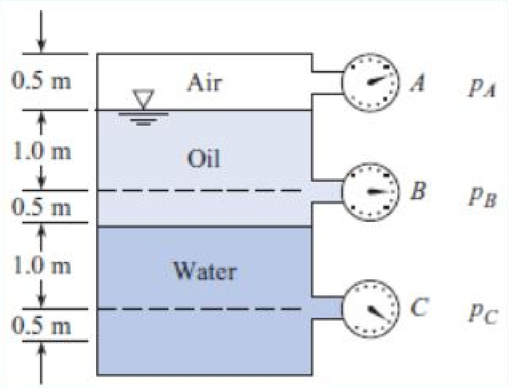
Question 1

Not yet answered

Marked out of 3.00

Flag question

For the closed tank with pressure gages readings of $P_A = 20$ kPa, and $P_B = 27.5$ kPa. Assume the water density is 1000 kg/m^3.



The specific gravity of the oil (rounded to three decimal digits e.g. 1.278), is:

Answer:

0:57:02 الوقت المتبقي

The diagram below shows a horizontal nozzle discharging water into the atmosphere. Th[e] inlet has area =600 mm^2 and the outlet has area=200 mm^2. The inlet pressure is 400 kP[a] and the outlet pressure is zero. Assume water density 1000 kg/m^3.

The volume flow rate of water in the nozzle in m^3/s is:

جواب:

الصفحة التالية

Question 13

Not yet answered

Marked out of 4.00

Flag question

Steel balls 12 mm in diameter are annealed by heating to 1150 K and then slowly coolin
to 400 K in an air environment for which temperature *is* 325 K and h= 20 W/m.K
Assuming the properties of the steel to be k= 40 W/m.K and the density is 7800 kg/m^3. and
c= 600 J/kg.K.

The estimated time required for the cooling process in seconds is:

Answer: 1121.79

Question 14

Not yet answered

Marked out of 2.00

Flag question

The Biot number is:

Answer: 1*10^-3

Time left 0:44:16

Quiz nav

Question 6

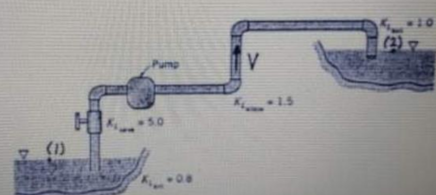
Not yet answered

Marked out of 4.00

Flag question

The pump shown in the figure below has a head of 250 m. The difference in the elevation is 200 m. Pipe length and dimeter are 500 m and 0.075 m respectively. Note: pipe is smooth (i.e. roughness is zero).

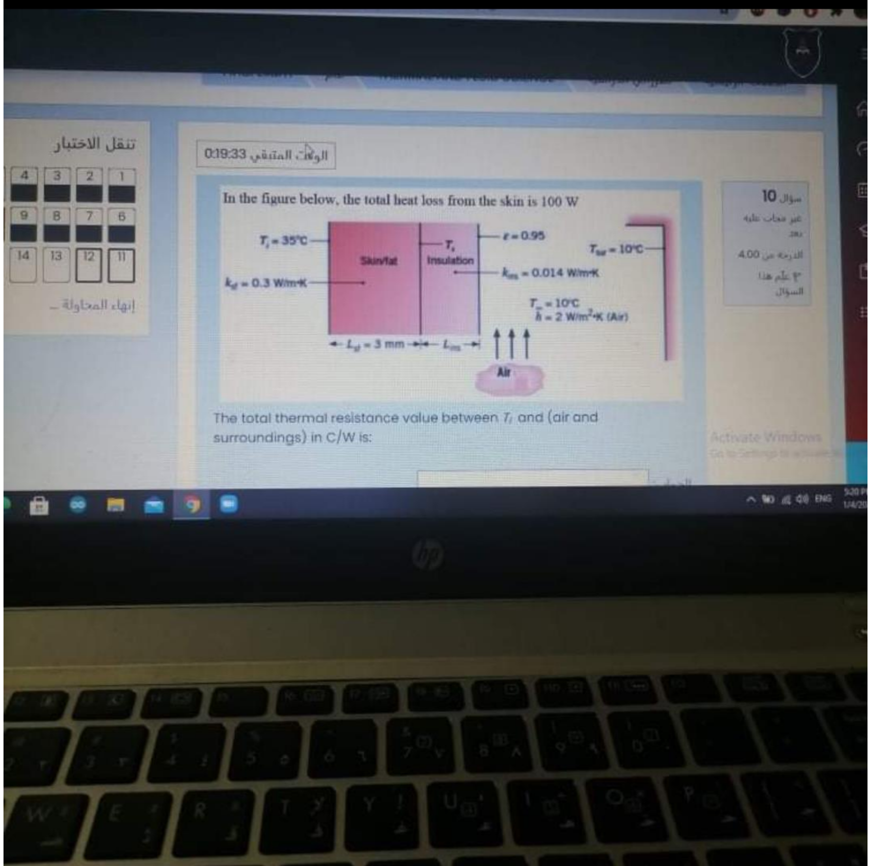
Assume water density 1000 kg/m^3 and dynamic viscosity is 1.792x 10^{-3} kg/m·s



The Re number value is:

Finish attem

THERMAL🔥



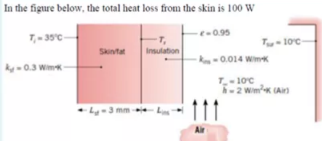
المزيد

تعديل

Time left 0:27:15

Question 10
Not yet answered
Marked out of 4.00
Flag question

In the figure below, the total heat loss from the skin is 100 W



The total thermal resistance value between T_i and (air and surroundings) in C/W is:

Answer:

Question 11
Not yet answered
Marked out of 4.00
Flag question

The value of T_s in C is:

Answer:

Question 12
Not yet answered
Marked out of 4.00
Flag question

The insulation thickness L_{ins} in mm is:

Answer:

المزيد تعديل

22:17 21% Zain JO

Time left 0:52:07

Quiz navig

1 2 3 7 8 9 13 14

Finish attempt

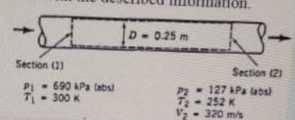
Question 4

Not yet answered

Marked out of 4.00

Flag question

Air flow in the pipe shown below with the described information.



The inlet velocity in m/s is:

Answer:

Question 5

Not yet answered

The air density at the exit in kg/m^3 is:

Answer:

22:16 21% Zain JO

Question 1

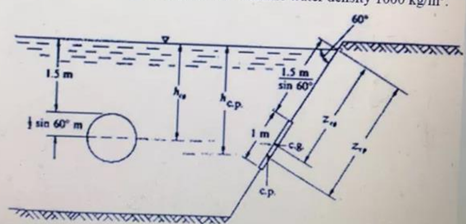
Not yet answered

Marked out of 4.00

Flag question

Time left 1:01:04

An inclined, cylindrical gate with water on one side is shown in figure, here c.p. represents the location of center of pressure. Assume water density 1000 kg/m^3.



The hydrostatic pressure force on the gate in kN is:

Quiz navigat

Finish attempt ...

Ghaith Attallah A replied to a mess Thermal and Fluid Sc

Type here to search

Q.3 4 kW heat removed.

$T_1 = 297K$

$T_2 = 308$

$$COP = \frac{T_1}{T_2 - T_1} = \frac{297}{308-297}$$

$(COP)_R = 27$

$(COP)_H = (COP)_R + 1 = 28$

$$(COP)_R = \frac{Q_L}{W_{input}}$$

$$COP) = 27 = \frac{4\,kW}{W_{input}}$$

$W_{input} = 0.148\ kW$

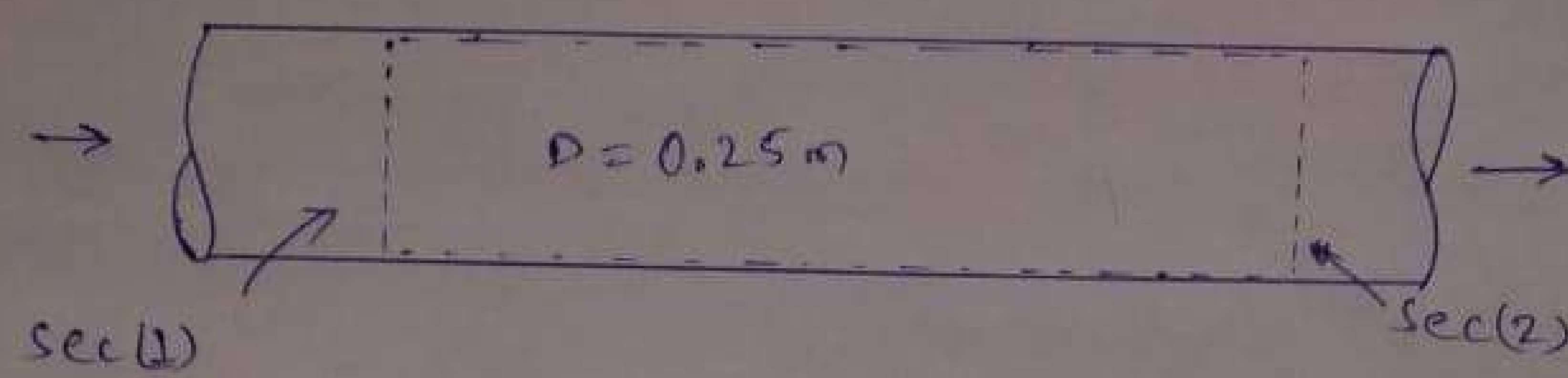
(a) heat rejected

$Q_R = Q_L + W_{input}$

$Q_R = 4.148\ kW$

(b) power input = 0.148 kW

Sol^n



Given,

inlet conditions,

$P_1 = 690$ KPa

$T_1 = 300$ K

Exit condition,

$P_2 = 127$ KPa

$T_2 = 252$ K

$V_2 = 320$ m/s

• Assuming mass flow rate ($\dot{m}$) at inlet and exit remains constant,

$$\therefore \quad \dot{m} = \frac{A V_1}{v_1} = \frac{(A V_2)}{v_2}$$

$$\Rightarrow \quad P_1 \frac{(A V_1)}{(R T_1)} = \frac{P_2 (A V_2)}{R T_2}$$

$$\therefore \quad V_1 = \left(\frac{P_2 V_2}{T_2}\right)\left(\frac{T_1}{P_1}\right)$$

Substituting with values given, i.e.

$$V_1 = \left(\frac{127 \times 320}{252}\right) \cdot \left(\frac{300}{690}\right)$$

$$\boxed{V_1 = 70.12 \text{ m/s}}$$

or,

inlet velocity of Air is **70.12 m/s**. Ans

(2) $q_{cond.} = \frac{KA}{L}(T_1 - T_2)$

$q_{cond.} = \frac{0.035\,A}{L}(290 - 43)$

$q_{cond.} = \frac{8.645\,A}{L}$

Heat transfer by convection $\Rightarrow$ $q = hA(T_1 - T_2)$

$q = 12 \times A \times (43 - 33)$

$q_{conv.} = 120\,A$

$\because$ $q_{cond.} = q_{conv.}$

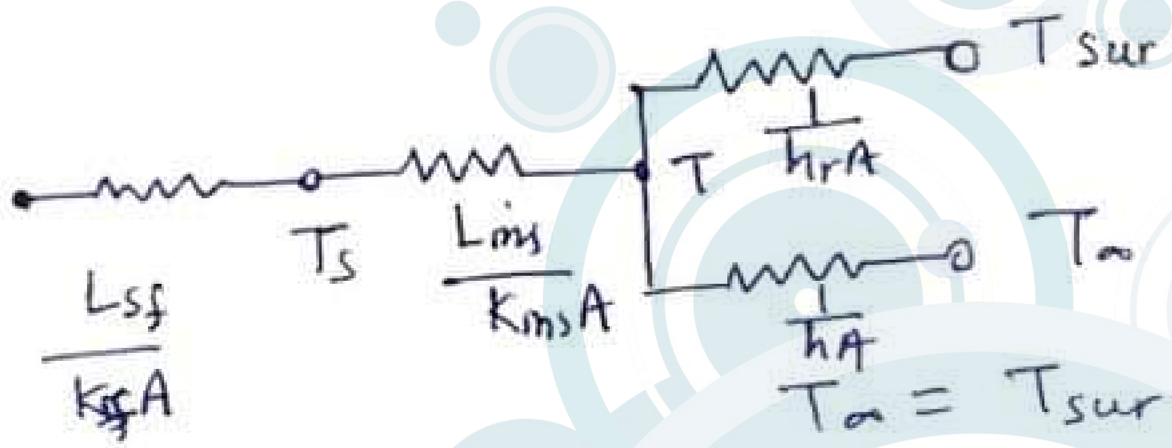
$\frac{8.645\,A}{L} = 120\,A$ $\Rightarrow$ $L = 0.072\,m$

$L = 7.2\,cm$

Insulation thickness = 7.2 cm

Heat loss is 100 W

So, $R_{total} = \frac{(T_i - T_\infty)}{100\,W} = \frac{35-10}{100} = \boxed{0.25\,°C/W}$



$$R_{tot} = \frac{L_{sf}}{k_{sf}A} + \frac{L_{ins}}{k_{ins}A} + \left(\frac{1}{1/hA} + \frac{1}{1/h_rA}\right)^{-1}$$

$$= \frac{1}{A}\left(\frac{L_{sf}}{k_{sf}} + \frac{L_{ins}}{k_{ins}} + \frac{1}{h+h_r}\right) \quad \text{— (1)}$$

$h_r \approx 5.9$, $A = 1.8\,m^2$; $h_r = \varepsilon\sigma(T^4 - T_{surr}^4)$

From eq (1)

$$L_{ins} = k_{ins}\left(A R_{tot} - \frac{L_{sf}}{k_{sf}} - \frac{1}{h+h_r}\right)$$

$$= 0.014 \times \left(1.8 \times 0.25 - \frac{3\times10^{-3}}{0.3} - \frac{1}{2+5.9}\right)$$

$= 0.0044\,m$

$\boxed{L_{ins} = 4.4\,mm}$

$$\text{major head loss} = \frac{0.0171 \times 500 \times 2.7814^2}{2 \times 9.81 \times 0.075}$$

$$\simeq 44.95\,m \quad \text{Ans}$$

$$\text{minor head loss} = 12.8 \times \frac{2.7814^2}{2 \times 9.81}$$

$$= 5.047\,m \quad \text{Ans}$$

$P_1 = P_2, \quad V_1 \simeq V_2$

$$250 = 200 + \frac{fLv^2}{2gd} + 12.8\frac{v^2}{2g}$$

$$50 = \left[\frac{f \times 500}{2 \times 9.81 \times 0.075} + \frac{12.8}{2 \times 9.81}\right] v^2$$

Trail-I

assuming flow is turbulent

$Re = 4000$

$f = \frac{0.316}{Re^{1/4}} \Rightarrow f = 0.03973 \quad (4000 < Re < 10^5)$

$v = 1.8796$ m/s

$$Re = \frac{\rho v d}{\mu} = \frac{10^3 \times 1.8796 \times 0.075}{1.792 \times 10^{-3}}$$

$Re = 78666.2946$

Trail-II

$Re = 78666.2946$

$f = 0.018867$

$v = 2.6649$ m/s

$Re = 111533.2081$

Trail-III

$f = 0.0032 + \frac{0.221}{Re^{0.237}} \quad (10^5 < Re < 4 \times 10^7)$

$f = 0.0173$

$v = 2.7670$ m/s

$Re = 115806.3616$

Trail IV

$f = 0.0171$

$\boxed{v = 2.7814 \text{ m/s}}$ Ans

$\boxed{Re = 116409.040}$ Ans

(1) $\frac{T - T_i}{T_o - T_i} = e^{-\left(\frac{hA_s}{\rho V C_p}\right) \times \tau}$

Properties of water at $0°C \Rightarrow \rho = 999.8\ kg/m^3$

$C_p = 4217\ J/kg \cdot K$

$$\frac{0 - 25}{-10 - 25} = e^{-\left[\frac{4 \times 3}{2.5 \times 10^{-2} \times 999.8 \times 4217}\right] \times \tau}$$

$\tau = 2955.45$ sec

$\tau = 49.25$ minutes

major head loss $(h_L)_1 = \frac{f L V^2}{2gd}$ f - darcy's friction factor.

minor loss $(h_L)_2 = 0.8 \frac{V^2}{2g} + 5 \times \frac{V^2}{2g} + 4 \times 1.5 \times \frac{V^2}{2g} + 1.0 \, V^2/2g$

$$(h_L)_2 = 12.8 \frac{V^2}{2g}$$

$$(h_L)_1 = f \frac{L V^2}{2gd}$$

$H_p = 250\,m$, $z_2 - z_1 = 200\,m$, $L = 500\,m$, $d = 0.075\,m$.

$\rho = 1000\,kg/m^3$, $\gamma = 9.782$ $\mu = 1.792 \times 10^{-3}\,kg/m\text{-}s$

Apply Bernoullies equation b/w ① & ②

$$\frac{P_1}{\gamma_w} + \frac{V_1^2}{2g} + z_1 + H_p = \frac{P_2}{\gamma_w} + \frac{V_2^2}{2g} + z_2 + (h_L)_1 + (h_L)_2$$

Now Finding T_s

$$T_s = T_i - \frac{(100) \times L_{sf}}{K_{sf} A}$$

$$= 35^\circ C - \frac{100 \times 3 \times 10^{-3}}{0.3 \times 1.8} = 34.4^\circ C$$

$$\boxed{T_s = 34.4^\circ C}$$