

Arch 463
 ECS
 Fall 2000

Name _____

Quiz #2

"Cooling a Three-Piece Suite"

For this problem you are the designer (with passive cooling in mind) for a remodel of an abandoned big rig trailer. Your client, a ceramic artist, wants to convert the wheelless trailer into a live/work environment on a shopping mall parking lot in St. Louis, MO. The orientation of the trailer in the lot is your choice. The trailer will contain three spaces of equal size—a 10' x 9' studio apartment, a 10' x 9' studio space, and a 10' x 9' studio support area. The trailer is made of uninsulated sheet steel walls with steel studs on a wood floor over a steel deck. You may specify an outer building skin. The artist has purchased a storefront curtain wall to replace the trailer's missing rear doors. The storefront windows are fixed-glass, only the 3' x 8' door is operable. You will be asked to design a shading device for this aperture. There are no other openings in the trailer shell, but you will be allowed to insert two operable 4' x 4' windows and a 2' x 2' operable metal roof hatch.

Climate Context. St. Louis is located at 38° north latitude. It has a hot humid summer climate with mild winters. Prevailing winds blow from the southwest throughout the year. Winds are available year round and average 5 to 8 mph.

Read all of the questions before you start answering the first one!!!!

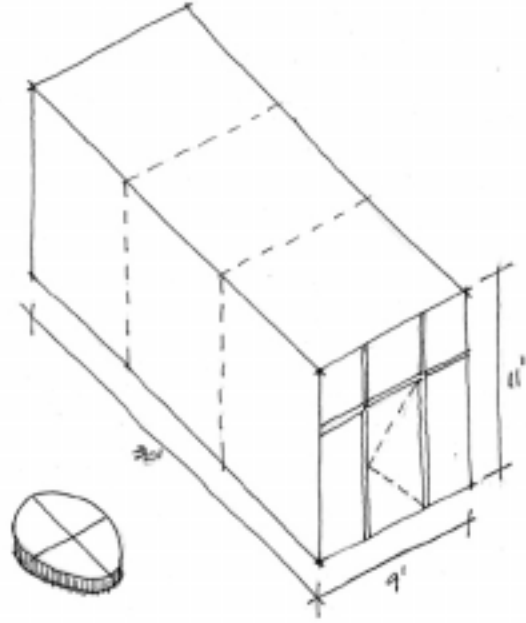
Mean Hourly Dry Bulb Temperature (Skin Load Dominated Bldg) (degrees Fahrenheit)												
	balance point = 55° F											
	J	F	M	A	M	J	J	A	S	O	N	D
1 am	25.2	29.3	41.1	52.3	61.8	69.8	72.1	73.3	63.9	50.1	42.0	27.8
2	24.2	28.8	40.4	51.3	60.9	68.8	71.2	72.5	63.1	49.7	41.1	27.3
3	23.2	28.3	39.7	50.3	60.0	68.0	70.3	71.9	62.3	49.2	40.5	26.8
4	22.8	27.9	39.5	49.9	58.8	66.9	70.3	71.2	61.9	48.5	40.1	26.9
5	22.3	27.5	39.1	49.4	58.1	66.3	70.2	70.5	61.5	47.8	39.4	26.6
6	21.8	27.1	38.8	48.9	58.8	67.7	70.2	70.3	61.1	47.6	39.1	26.4
7	22.5	28.2	39.1	51.7	61.7	69.5	73.2	72.0	63.9	48.4	39.2	26.4
8	23.1	29.3	40.3	54.6	64.2	72.7	76.3	75.2	66.8	51.5	40.3	26.9
9	23.7	30.4	42.7	57.4	66.9	75.4	79.3	77.6	69.7	54.3	42.5	28.5
10	26.3	32.6	44.8	59.7	68.7	77.2	80.9	79.6	71.9	57.1	44.9	30.5
11	28.8	34.8	46.9	62.0	70.6	79.1	82.6	81.1	74.0	57.3	47.1	32.4
12 noon	31.4	37.0	48.3	64.3	72.4	81.5	84.3	82.6	76.2	61.9	49.0	34.3
1 pm	32.4	38.3	50.3	65.3	74.1	82.4	85.3	83.8	76.9	63.1	50.5	36.0
2	33.5	39.5	51.4	66.3	75.3	83.1	86.2	84.4	77.7	63.7	51.4	36.7
3	34.6	40.7	52.1	67.3	76.0	83.2	87.3	84.9	78.4	64.3	51.5	36.8
4	32.9	39.1	52.3	65.9	76.2	83.2	86.2	84.4	76.7	63.5	50.9	35.6
5	31.2	37.4	51.4	64.4	75.4	82.1	85.2	83.4	74.9	61.4	49.4	33.4
6	29.6	35.8	49.8	63.0	73.8	81.1	84.1	82.4	73.2	58.3	47.5	32.3
7	28.8	34.7	47.9	60.8	71.4	78.0	81.7	80.4	71.2	55.9	46.8	31.4
8	28.1	33.6	46.7	58.6	68.7	75.4	79.3	78.8	69.6	54.2	45.9	30.8
9	27.4	32.6	45.6	56.4	66.7	74.0	77.0	77.3	67.2	53.4	44.5	29.6
10	26.8	31.8	44.4	55.5	65.8	72.5	75.6	76.0	66.3	52.5	43.5	29.1
11 pm	26.3	31.0	43.3	54.3	64.3	71.6	74.2	75.1	65.5	51.6	42.9	28.6
12 mid	25.7	30.3	42.3	53.8	62.9	71.0	72.9	74.2	64.7	50.6	42.0	28.4
	Cold < 32		Cool 32-55			Comfort 55-69.9			Hot ≥ 70			

Average hourly temperature plot for St. Louis, MO. from Washington University's Mean Hourly Climate Data.

2 points

1. Thermal Zoning

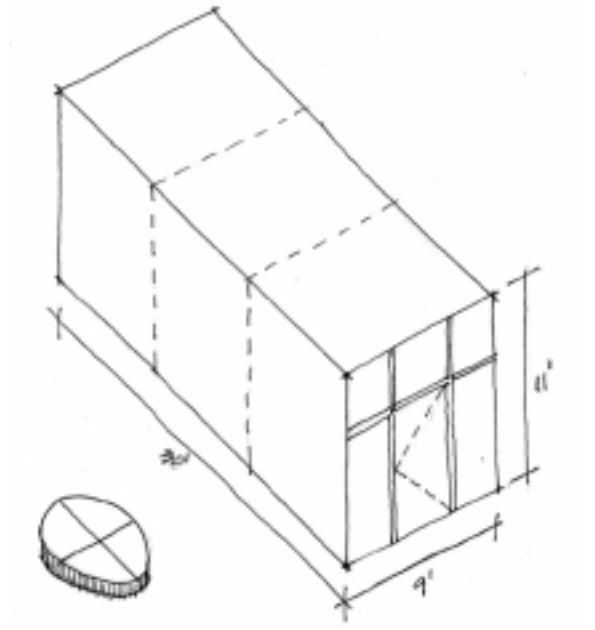
The studio apartment is for sleeping/cooking/eating/hygiene, the studio space is for throwing pots/display/sales, and the studio support area is for firing pots/storage. Mechanical equipment in the trailer includes a kiln, a stove, a hot-water heater, and a pottery wheel. **Indicate** your choice for placing the three spaces in the trailer. **Explain** your thermal zoning strategy in the context of the St. Louis climate and the building program. Use **annotated sketches** to make your design intentions and argument clear.



3 points

2. Orientation and Shading

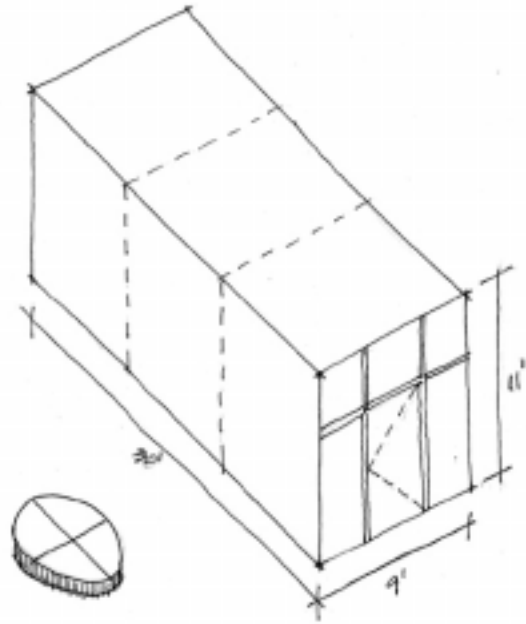
Indicate the orientation of the trailer by completing the north arrow diagram. **Explain** why you chose this orientation. **Design and sketch** the appropriate shading device for the curtain wall entry to the suite. **Explain** why it's appropriate.



3 points

3. Materials and Apertures

Specify a.) concrete panels, b.) plywood panels, or c.) insulated panels as outer skin elements for the trailer's sides and roof. **Explain** your choice(s). **Indicate** the position and appropriate shading devices for the two 4' x 4' operable windows and the 2' x 2' operable metal roof hatch. **Explain** their roles in passive cooling.



2 points

4. Scenario

Explain how the passive cooling strategies you have designed for the building should be used to maximize occupant comfort at 3p.m. in August.