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Show details of your calculations

1. Calculate the solar time and hour angle for the following cases:
   a) Jeddah, on July 15, T_c=10
   b) Dahran (Az-Zhran), on May 25, T_c=13

 2. Calculate the sunset and sunrise times based on **local time** for
Makkah, on Dec. 10. Check your results with UmmUlgorah Calendar

3. Calculate the sun position (β, φ) for
a) Jeddah, on Oct. 20, T_s=9
b) ℓ=16°N, on Nov. 21, T_s=14. Check your results with ASHRAE tables

4. Calculate the incident angle θ, and profile angle Ω for the following cases
a) ℓ=24°N, T_s=15, Σ=90°, ψ=-45°, June 21.
b) Jeddah, T_s=10, Σ=30° , ψ=45°, Aug. 21.

Show the details of your work, and fill the table below

case	ℓ	n	T_s	h	δ	β	θ_z	φ	Σ	ψ	γ	θ	Ω
a													
b													

5-Using ASHRAE clear sky model, calculate the direct diffuse, and total solar radiation falling in a
window facing SSW, given the following information
    -Date: Aug. 21
    -Window is located on Makkah Almukaramah
    -Solar time is 2 PM.
    -Ground reflectance is 0.3

n	Ts	l	δ	β	θ_z	φ	ψ	γ	θ	A	B	C	G_{DN}	G_D	G_d	G_t

Show the details of your calculations.

6-Consider a window of 3 meter wide and 2 meter high located in Riyadh. Calculate the sunlit area
at 10 AM solar time on Oct. 21, if the set back distance is 30 cm. The window is facing south east.

7-Consider a south facing window with dimension 4 by 6 feet. Due an overhang, the shadow
height is 2.3 feet. The frame is made of Aluminum with width of 2 inches. Assume G_D=300
Btu/ft^2.hr, G_d=90 Btu/ft^2.hr. Calculate the solar and conduction heat gain due to this window