H_{total}	R	F	E	ρ	H_i	σ_i	σ_{total}	τ_i	τ_{total}
cm			mm	kg/m3	m	Pa	kPa	Pa	kPa
92									
	F	⁄	2	100	0.07	68.6	0.0686	39.35	0.0394
85									
	P	◎◎	N/A	300	0.01	29.4	0.098	16.86	0.0562
84									
	1F	●	1.5	230	0.11	248.19	0.34619	142.39	0.1986
73									
	P	●	1	275	0.04	107.91	0.4541	61.907	0.2605
69									
	4F	⚹△	1	300	0.02	58.86	0.51296	33.767	0.2943
67									
	P	∞	2	350	0.11	377.69	0.89065	216.41	0.5107
56									
	1F	●	1	300	0.14	412.02	1.30267	236.09	0.7468
42									
	4F	∨	3	110	0.01	10.791	1.31346	6.1832	0.753
41									
	1F	□	2	250	0.07	171.68	1.48513	98.37	0.8513
34									
	1F	⍓	1.5	275	0.03	80.933	1.56607	46.374	0.8977
31									
	K	∞	2.5	450	0.08	353.16	1.91923	202.36	1.1001
23									
	1F	□	2	250	0.05	122.63	2.04185	70.264	1.1703
18									
	4F	∧	3	320	0.18	565.06	2.60691	323.78	1.4941
0									

Part II:

Let's explore the kinds of additional stress needed to make the following layers fail in shear. We can do this two ways: Increase the angle of the slope or increase the mass on top of the layer in question.
Failure will occur when stress = strength (or when stress is greater than the strength).

1. First let's look at the shear stress on the bottom of the surface hoar layer, at 41 cm. Use your number for the total stress on this interface, τ_{total}, to determine whether there is initially failure in shear at 41cm on this 35 degree slope. Assume the shear strength of the layer was measured at .950 kPa.

$\tau_{total} < T \quad (0.753\,kPa < 0.950\,kPa)$

therefore, no initial failure

2. Given the current stress on the layer at 41cm, calculate at what slope angle shear failure will occur. Remember, failure occurs when $T = \sigma_{total} \cdot \sin\psi$.

$$T = \sigma_t \sin\psi$$

$$\sin\psi = \frac{T}{\sigma_t}$$

$$\psi = \sin^{-1}\left(\frac{T}{\sigma_t}\right) \longrightarrow \psi = \sin^{-1}\left(\frac{0.950\,kPa}{1.313\,kPa}\right)$$

$$\boxed{\psi = 46.35^\circ}$$

3. Again using the data for the bottom of the surface hoar layer, and assuming the slope is again at 35 degrees, calculate how much additional snow with a density of 100 kg/m^3 needs to fall before failure will occur in shear.

Additional stress needed $(\tau_A) = T - \tau_{total}$

$$\tau_a = 0.95\,kPa - 0.752\,kPa$$

$$\tau_a = 0.198\,kPa$$

$$\tau_a = \frac{\rho g H}{1000} \sin 35$$

$$H = \frac{\tau_a \cdot 1000}{\rho g \sin 35}$$

$$H = \frac{0.198\,kPa \cdot 1000\,Pa/kPa}{100\,kg/m^3 \cdot 9.8\,m/s^2 \cdot \sin 35} = 0.352\,m = \boxed{35.2\,cm}$$