



# **TOUGH Questions**

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# Question 1 (Constant T injection)



In a non-isothermal problem with EOS3, if you want to inject air at constant rate in gridblock A11 1 using the GENER block to create an outflow of air from A11 1 at constant-temperature T1, do you

- ~~A.~~ Set the volume of gridblock A11 1 to  $10^{50} \text{ m}^3$ , assign its temperature to T1, and inject at constant rate?
- ~~B.~~ Set the porosity of gridblock A11 1 to  $10^{10}$ , assign its temperature to T1, and inject at constant rate?
- ~~C.~~ Set parameter EX (J/kg) equal to  $C_p(\text{air}) \cdot T1$  in the GENER block, and inject at constant rate?
- D. Set the heat capacity (SPHT) of the rock in gridblock A11 1 to  $10^{10} \text{ (J/kg } ^\circ\text{C)}$  with gridblock temperature set to T1, and inject at constant rate?
- E. Set the density (DROK) of the rock in gridblock A11 1 to  $10^{10} \text{ (kg/m}^3\text{)}$  with gridblock temperature set to T1, and inject at constant rate?



## Question 2 (Suppressing BALLA)



In a problem for which large-volume gridblocks are used to maintain constant-value boundary conditions, how do you force TOUGH2 to ignore the large-volume boundary gridblocks in the global material balance calculation (subroutine BALLA)?

- ~~A.~~ Set DROK ( $\text{kg/m}^3$ ) in the ROCKS block to greater than  $10^4$  for the large-volume gridblocks.
- ~~B.~~ Set CWET ( $\text{W/m } ^\circ\text{C}$ ) in the ROCKS block to greater than  $10^4$  for the large-volume gridblocks.
- C.** Set SPHT ( $\text{J/kg } ^\circ\text{C}$ ) in the ROCKS block to greater than  $10^4$  for the large-volume gridblocks.
- ~~D.~~ Set MAT (material name) in the ROCKS block to “bdry” for the large-volume gridblocks.
- E. None of the above.



## Question 3 (INCON from different EOS)



Suppose you want to initialize an EOS7R problem using an INCON file copied from a SAVE file from an EOS7 run. Which of the following is the correct procedure to ensure proper reading of primary variables?

- ~~A.~~ Set  $MOP(19) = 1$  in PARAM with  $NKIN = NEQ$  in the MULTI block;
- ~~B.~~ Include the START record in the input file, no other changes;
- ~~C.~~ Ensure START is not present, set  $NKIN = 5$  in the MULTI block;
- ~~D.~~ Set  $NKIN = 5$  in the MULTI block;
- E.** None of the above.



## Question 4 (Resetting porosity)



Suppose you want to read from an INCON file copied from a SAVE file from a prior run. In the new run, you want to use a different porosity. Do you

- ~~A.~~ Set POR in ROCKS to the desired new value(s), and ensure START is present?
- ~~B.~~ Set PORX in INCON equal to the new value(s)?
- ~~C.~~ Set PORX in INCON equal to zero or blank, ensure START is present, and set POR in ROCKS to the desired value(s)?
- ~~D.~~ Do A or B?
- E.** Do B or C?



## Question 5 (Mixed $k_{rel}$ )



Suppose you want to use the van Genuchten relative permeability function for liquid while using the Corey function for the gas in the same problem. Do you

→ ~~A.~~ Use  $IRP = 7$  (van Genuchten-Mualem model), with  $S_{gr} = 0$ ?

**B.** Use  $IRP = 7$  (van Genuchten-Mualem model) with  $S_{gr} > 0$ ?

~~C.~~ Use  $IRP = 7$  (van Genuchten-Mualem model) with  $S_{lr} > 0$ ?

~~D.~~ Use  $IRP = 3$  (Corey) with  $S_{gr} > 0$ ?

E. None of the above.



# Scoring

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- A. Four or Five correct answers. Wow.**
- B. Three correct answers. Excellent.**
- C. Two correct answers. Very good.**
- D. One correct answer. Try more new things with TOUGH2.**
- E. Zero correct answers. Sign up for the TOUGH training course.**

