Introduction to Carbon Capture and Storage
(이산화탄소 포집 및 저장 개론) (38535-01)

- 2019 Final Examination -

Student ID: **Name:**

Notice

- Fill your name below:

  "I, _____, swear I solve all problems by myself in this final examination.

  I will take any disadvantages if any dishonesty such as cheating is acted on my solution."

  5 points will be deducted from your total score if you do not fill in your name above.

Problem 1.

Give the full name for each abbreviated term:

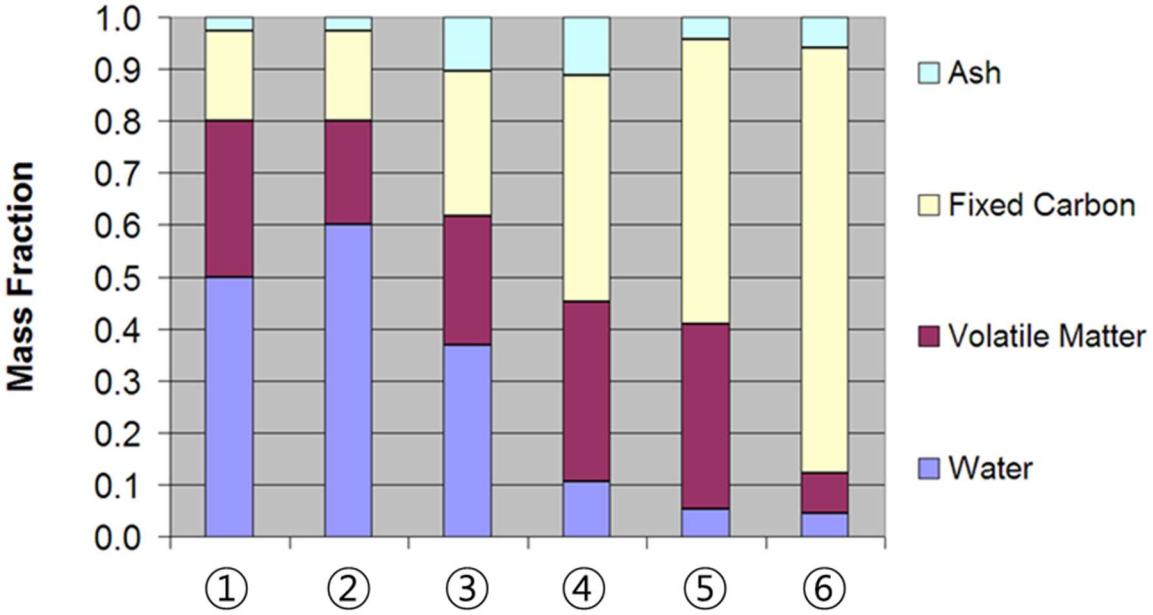
1-1. CO_2e [2 pts.]
1-2. GWP [2 pts.]
1-3. IGCC [2 pts.]
1-4. TPES [2 pts.]
1-5. UNFCCC [2 pts.]

Problem 2.

Explain electricity generation capacity and gross generation with their relationship. [10 pts.]

Problem 3.

Below is a figure of typical coal compositions. Address six coal types from ① to ⑥ on the horizontal axis. [15 pts.]



Problem 4.

4-1. Explain main differences between post-combustion CO_2 capture and oxy-combustion CO_2 capture within 5 sentences. [10 pts.].

4-2. For the pre-combustion CO_2 capture from power generation, describe the chemical reaction of steam reforming of coke to give water gas. Is steam reforming endothermic or exothermic? [5 pts.]

4-3. For the pre-combustion CO_2 capture from power generation, describe the chemical reaction of water-gas shift reaction. Is this shift reaction endothermic or exothermic? [5 pts.]

Problem 5.

Select absorbents from the list below. You will earn 1 point from any correct selection while losing 1 point from any incorrect selection. [5 pts.]

"MEA, zeolite, MOF, CORAL, inorganic-organic hybrid, potassium carbonate, Rectisol, Selexol, mesoporous carbon"

Problem 6.

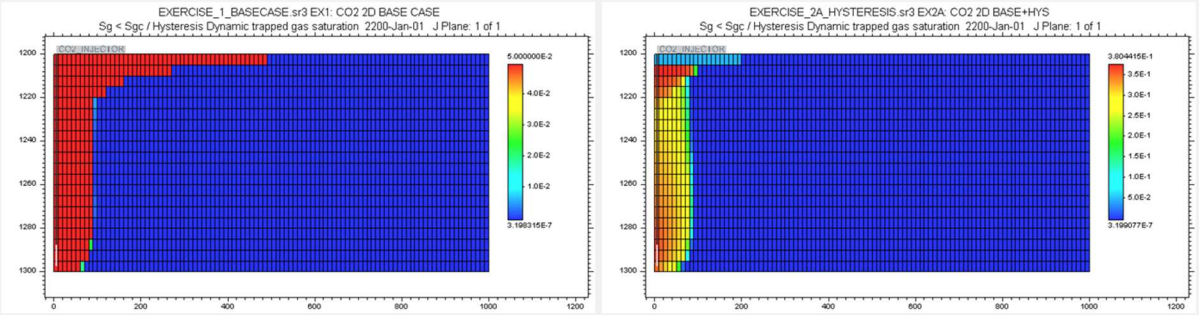
6-1. Show the definition of Cost of CO_2 avoided. [5 pts.]

6-2. Calculate the cost of CO_2 avoided for the following example [15 pts.].

- A CCS plant is built over 2 years at a natural gas production plant at a cost of $160 million.
- The amount of CO_2 avoided is 2 million tonnes annually and the plant operates for 6 years at a cost of $40 million annually.
- Decommissioning takes 2 years at a cost of $40 million.
- All energy for CCS is provided by the natural gas plant.
- The discount rate is 10%.
- Ignore taxes.
- You MUST round off all values (e.g., discount factor) to the second decimal place for this example. (모든 수치 계산은 소수 둘째자리까지 구하시오.)

Problem 7.

Below are figures to show simulation results of structural trapping and hysteresis trapping where CO_2 has been injected for 1 year and migrated for subsequent 200 years. Interpret the results based on your engineering knowledge [10 pts].



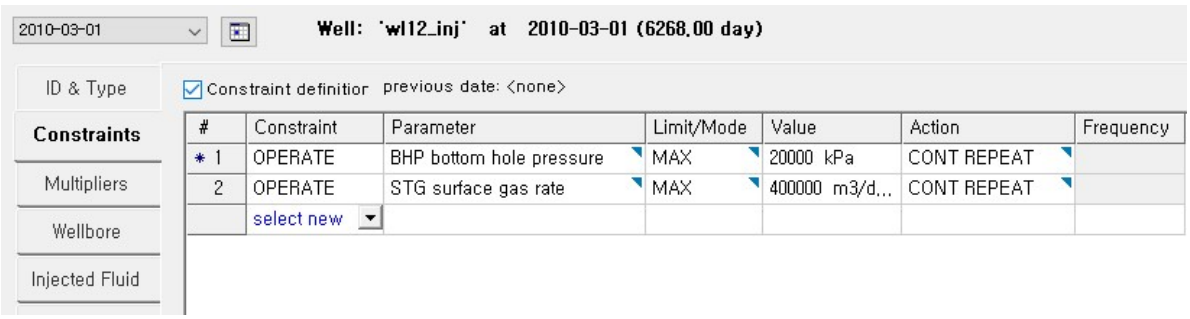
Problem 8.

List the following procedures of CMG reservoir simulation in order. [5 pts.]

(A) Initialization Settings
(B) Reservoir Definition
(C) Fluid Definition
(D) Well Definition & Operation
(E) Rock-Fluid Information
(F) Numerical Controls
(G) Run & Results

Problem 9.

Describe operating conditions for a CO_2 injection well, as shown in the figure below. What will happen if the wellbore pressure reaches 20,000 kPa? [5 pts.]



---------- This is the End of the Final Examination ----------