EXAM PART B – PLUG & ABANDONMENT (P&A)

Maximum score is 100 points

1. Define the following terms: (**10p**)
    a. Well Integrity
    b. Well Barrier Element
    c. Well Barrier Envelope

2. Write three reasons for not being able to perform P&A activities rigless. (**15p**)

3. Consider a permanent barrier, rock-to-rock barrier, is going to be established during a permanent P&A operation. The casing cement has poor quality and section milling is required. The production casing is a 9 5/8-in. casing with the following specification:

Weight	40 lbm/ft
ID	8.835-in.
Capacity	0.07582 bbl/ft

   Consider NORSOK D-010, revision 4, as the recommended practice to be used for designing the operation and using back-to-back cement plug to establish primary and secondary permanent barriers. How many metric tons of swarf is generated to establish the primary and secondary barriers? Assume that a mechanical foundation is used as base for the cement plug. (**10p**)

4. You are asked to install a balanced plug across a suitable formation. For this job, a 4 ½-in. drillpipe will be used as workstring in an open hole with 8 ¾-in. diameter. The plug length is expected to be 400 ft and 30 bbl of fresh water will be pumped ahead of cement as spacer. Additional information: String capacity = 0.01422 bbl/ft, annular capacity = 0.0547 bbl/ft. State your assumptions if necessary. (**10p**)

    a. Calculate the required volume of cement.
    b. Calculate the height of the cement plug with workstring in.
    c. Calculate the required volume of spacer behind.
    d. Calculate the volume of displacement fluid.

5. When in-situ formation creeps toward casing, it can create an annular barrier. The driving mechanism is believed to be “creeping formation”. Explain the creep phenomenon, briefly. (**5p**)

6. A well is in temporarily abandoned status and an engineer is considering to permanently abandon the well. A bridge plug, with 20 m cement on top of it, has been used as barrier for temporary P&A. Can the cement and bridge plug be used as permanent primary and secondary barriers? List two reasons to back up your answers. (**10p**)

7. CBL (Cement Bond Log) and VDL (Variable-Density Log) are used as adjunct for better insight into interpretation. Briefly, explain the following terms: (**10p**)
    a) Amplitude
    b) CBL Bond Index

8. Logs are used to verify cement behind casing. There are special cases should be taken into consideration for qualitative interpretation of cement logs. Explain how the followings can affect interpretations: (**10p**)
    a) Unconsolidated formations
    b) Fast formations
    c) Salt formations
    d) Intimate contact between the casing and formation

9. Consider a cement plug installed inside casing in an interval with qualified casing cement. Pressure testing is necessary to be performed to qualify the cement plug. (**15p**)
    a) What is “negative pressure testing”? This type of test is also known as “inflow test”.
    b) What is “positive pressure testing”?
    c) How the positive pressure testing can affect and mislead the data interpretation due to ballooning effect?

10. All the followings are the roots which can cause leak around the bulk material EXCEPT: (**1p**)

    a. Shrinkage and expansion

    b. Chemical degradation

    c. Diffusive leakage

    d. Poor quality of barrier placement

11. Select the right answer: (**1p**)

    a. Temperature logging is often used to evaluate primary cement jobs.

    b. Temperature logging is mainly used to detect the top of the cement column.

    c. Temperature surveys are performed to detect leaks or channeling.

    d. All the above-mentioned items are correct.

12. Absence of SCP (Sustained Casing Pressure) during the life cycle of the well indicates that … (**1p**)

    a. Poor sealing capability of the casing cement.
    b. Milling operations is necessary.
    c. Running leak off test is necessary.
    d. Good sealing capability of the casing cement.

13. According to NORSOK D-010, Rev. 4, all the items are correct EXCEPT: (**1p**)

    a. Requirements for isolation of formations, fluids and pressures for temporary and permanent abandonment are the same.
    b. The overburden formation including shallow sources of inflow shall be assessed with regards to abandonment requirements.
    c. Multiple reservoir zones/perforations located within the same pressure regime shall not be regarded as one reservoir.
    d. Permanent well barriers shall extend across the full cross section of the well, include all annuli and seal both vertically and horizontally.

14. "Combination of the probability of occurrence of harm and the severity of that harm" is defined as: (**1p**)

    a. Leak
    b. Probabilistic cost estimation
    c. Risk
    d. Well integrity