

Final Exam Question

Artificial Intelligence:

You're running out of time on your exam, so you sneakily ask ChatGPT about the last question, below.

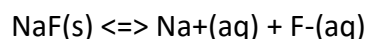
Given precipitation at a temperature of 313.8 K and a saturated solution of sodium fluoride with a concentration of 0.211 M, determine the solubility product and then calculate ΔG° .

ChatGPT responds with:

Determining Solubility Product (K_{sp})

Since we have a saturated solution of sodium fluoride (NaF) with a concentration of 0.211 M at 313.8 K, we can use this information to find the K_{sp} (solubility product constant).

Dissociation of NaF:



Solubility and K_{sp} Relationship:

In a saturated solution, the concentration of the dissociated ions ([Na⁺] and [F⁻]) is equal to the solubility (S) of NaF. Therefore, for NaF:

$$S = [\text{Na}^+] = [\text{F}^-] = 0.211 \text{ M}$$

The K_{sp} expression for NaF is:

$$K_{sp} = [\text{Na}^+] * [\text{F}^-]$$

Calculating K_{sp}:

$$K_{sp} = (0.211 \text{ M}) * (0.211 \text{ M}) = 4.45 \times 10^{-2} \text{ (at 313.8 K)}$$

Therefore, the solubility product of sodium fluoride at 313.8 K is 4.45×10^{-2} .

Calculating ΔG° (Standard Gibbs Free Energy Change)

Unfortunately, we cannot directly calculate the standard Gibbs Free Energy change (ΔG°) solely from the K_{sp} value. ΔG° is typically determined using standard electrode potentials or tabulated thermodynamic data, which are not provided for this specific reaction at 313.8 K.

However, there is a relationship between K_{sp} and ΔG° . Under standard conditions, the following equation holds:

$$\Delta G^\circ = -RT * \ln(K_{sp})$$

where:

- R is the gas constant (8.314 J/mol*K)
- T is the temperature in Kelvin (313.8 K in this case)
- ln is the natural logarithm

Although we cannot obtain the exact value of ΔG° , we can express it based on the K_{sp} :

$$\Delta G^\circ = - (8.314 \text{ J/mol}\cdot\text{K}) * (313.8 \text{ K}) * \ln(4.45 \times 10^{-2})$$

This equation shows that ΔG° for the dissolution of NaF at 313.8 K is positive due to the negative value of K_{sp} . A positive ΔG° indicates a non-spontaneous process under standard conditions.

- (4) Evaluate this answer. What score would you expect if you copied and pasted this response?
- (4) Briefly explain two ethical issues that would arise from using ChatGPT for your answer.

Assessment

The student's work will be assessed using the AAC&U Ethical Reasoning VALUE Rubric available at VALUE Rubrics - Ethical Reasoning | AAC&U (aacu.org)

For this assignment, two evaluation criteria of the ER Value Rubric were utilized which are: Ethical Issue Recognition and Evaluate Perspectives / Concepts. For convenience, the AACU Value Rubric is also provided below:

ETHICAL REASONING VALUE RUBRIC

for more information, please contact valuel@aacu.org



Definition

Ethical Reasoning is reasoning about right and wrong human conduct. It requires students to be able to assess their own ethical values and the social context of problems, recognize ethical issues in a variety of settings, think about how different ethical perspectives might be applied to ethical dilemmas, and consider the ramifications of alternative actions. Students' ethical self-identity evolves as they practice ethical decision-making skills and learn how to describe and analyze positions on ethical issues.

Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet benchmark (all one) level performance.

	Capstone 4	Milestones 3 2		Benchmark 1
Ethical Self-Awareness	Student discusses in detail/analyzes both core beliefs and the origins of the core beliefs and discussion has greater depth and clarity.	Student discusses in detail/analyzes both core beliefs and the origins of the core beliefs.	Student states both core beliefs and the origins of the core beliefs.	Student states either their core beliefs or articulates the origins of the core beliefs but not both.
Understanding Different Ethical Perspectives/Concepts	Student names the theory or theories, can present the gist of said theory or theories, and accurately explains the details of the theory or theories used.	Student can name the major theory or theories she/he uses, can present the gist of said theory or theories, and attempts to explain the details of the theory or theories used, but has some inaccuracies.	Student can name the major theory she/he uses, and is only able to present the gist of the named theory.	Student only names the major theory she/he uses.
Ethical Issue Recognition	Student can recognize ethical issues when presented in a complex, multilayered (gray) context AND can recognize cross-relationships among the issues.	Student can recognize ethical issues when issues are presented in a complex, multilayered (gray) context OR can grasp cross-relationships among the issues.	Student can recognize basic and obvious ethical issues and grasp (incompletely) the complexities or interrelationships among the issues.	Student can recognize basic and obvious ethical issues but fails to grasp complexity or interrelationships.
Application of Ethical Perspectives/Concepts	Student can independently apply ethical perspectives/ concepts to an ethical question, accurately, and is able to consider full implications of the application.	Student can independently (to a new example) apply ethical perspectives/ concepts to an ethical question, accurately, but does not consider the specific implications of the application.	Student can apply ethical perspectives/ concepts to an ethical question, independently (to a new example) and the application is inaccurate.	Student can apply ethical perspectives/ concepts to an ethical question with support (using examples, in a class, in a group, or a fixed-choice setting) but is unable to apply ethical perspectives/ concepts independently (to a new example).
Evaluation of Different Ethical Perspectives/Concepts	Student states a position and can state the objections to, assumptions and implications of and can reasonably defend against the objections to, assumptions and implications of different ethical perspectives/ concepts, and the student's defense is adequate and effective.	Student states a position and can state the objections to, assumptions and implications of, and respond to the objections to, assumptions and implications of different ethical perspectives/ concepts, but the student's response is inadequate.	Student states a position and can state the objections to, assumptions and implications of different ethical perspectives/ concepts but does not respond to them (and ultimately objections, assumptions, and implications are compartmentalized by student and do not affect student's position.)	Student states a position but cannot state the objections to and assumptions and limitations of the different perspectives/ concepts.