1. Awad distinguishes between different "types" of AI. What classification scheme does the paper use and why do these types matter for scientific research?
    a. The different types of AI Awad lists are:
        i. Descriptive AI: extracts and organizes patterns found in data
        ii. Predictive AI: able to make predictions based on previous data and trends
        iii. Generative AI: it creates hypothesis, simulations, data or content that supports scientific research
        iv. Optimization AI: it finds efficient solutions within difficult constraints and experimental settings
        v. Meta-scientific AI: automates hypothesis generation, experiment design, etc., of the scientific discovery process
        vi. Privacy-aware AI: protects sensitive data while enabling scientific analysis
        vii. Causal AI: finds cause and effect relationships
        viii. Explainable AI: makes complex models easier to interpret and transparent so it supports trust, validation, etc., in scientific research
    b. These different types of AI matter for scientific research because they allow for "exploration and explanation" within the scientific process (7). Because these different AI types perform pattern discovery, outcome prediction, scientific modelling, etc., these tools enhance the analytical and creative spaces needed in scientific research.
    c. Overall, Awad's classifications shows that AI isn't a single tool but are a set of special optimizations that contribute to different stages of the scientific method.
2. Does Awad make a clear distinction between AI as a tool and AI as a scientific collaborator? If so, what are the differences and what are some examples given to support the differences? Do these examples suggest a real shift in how science is conducted, or mostly an extension of existing methods?
    a. Awad says that AI is starting to act as collaborators. Specifically, she mentions AI being a "computational assistant" (Page 6) meaning it supports tasks such as data analysis, modelling, and pattern recognition. However, she also argues that AI is increasingly acting as "epistemic agents" which influence the scientific process. While a tool is used to assist complete tasks, a collaborator contributes actively to the research process. For example, Awad discusses how AI can support generation, predictive modelling, and experimental design, specifically through meta-scientific AI systems that can automate parts of the scientific method. These examples

suggest a shift in how science is conducted rather than an extension of existing methods. Since AI is contributing to "hypothesis generation, pattern recognition and predictive modelling, extending traditional methods of theory and experimentation" (Page 6), it's not only making research more efficient, but also reshaping how new knowledge is produced.

3. What are some limitations or risks of using AI in science? How do these relate to issues such as interpretability, bias, reproducibility, or theory formation?

    a. One limitation and risk of using AI in science is that can reflect "unintentional societal biases, including race and gender stereotypes" (Page 10). This relates directly to bias in datasets and models, which can influence scientific interpretations and outcomes.

    b. Another limitation is the lack of interpretability. Since some AI models function as "black boxes," it makes it difficult for scientists to fully understand how results are generated. This causes concerns about transparency and validation in scientific research.

    c. AI can also produce fake citations and misleading claims due to its generative and predictive nature. There is a risk of spreading misinformation or "hallucinations" which is detrimental as it can "weaken trust in science" (Page 12) and affect the reliability and reproducibility of scientific conclusions.

    d. Scientists still need to spend time validating the answers and outcomes given by AI as the model and data used influences its outcome. This can also impact reproducibility as insights can emerge from data patterns rather than the scientists' usual theoretical reasonings.

4. According to Awad's arguments, is AI more likely to accelerate scientific discovery or to reshape the scientific method itself? Do you agree or disagree?

    a. According to Awad's arguments, AI is likely to both accelerate scientific discovery and reshape aspects of the scientific method. She suggests that AI is not only a computational system but also contributes to hypothesis generation, reasoning, and knowledge production which indicates a deeper change in how science is conducted. However, I think AI is more likely to accelerate scientific discovery rather than fully reshape the scientific method. While AI can act as a collaborator, it still requires tuning, calibration, and validation by the scientific community. Scientists still have to interpret the results, verify the outputs, and correct errors such as hallucinations or misleading claims. Meaning that the core of the scientific method still heavily depends on humans. Additionally, although AI can produce errors, these mistakes do not necessarily mean that scientific progress is invalidated.

Much like historical scientific errors and unexpected findings, these errors can lead to new discoveries. Therefore, AI may speed up research, but I think it is more likely to enhance the scientific method rather than *completely* replace or reshape it.