

國立臺灣師範大學 113 學年度碩士班招生考試試題

科目：科學課程

適用系所：科學教育研究所

注意：1.本試題共3頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

一、十二年國教國高中自然科學領域課程綱要中的基本理念闡述中提及自然領域的學習目標：根據各學習階段學生的特質，選擇核心概念，再透過跨科概念與社會性科學議題，讓學生經由探究、專題製作等多元途徑獲得深度的學習，以培養科學素養。

(1)請說明什麼是『跨科概念』(5分)?並舉例。(2分)

(2)請說明什麼是『社會性科學議題』(5分)?並舉例。(2分)

(3)請說明什麼是『科學素養』?(6分)

二、十二年國教國高中自然科學領域課程綱要中『學習表現架構表』中除了探究能力之外，還包含了科學的態度與本質，如下所示。

(1)請說明什麼是『科學態度』?(5分)

(2)請說明什麼是『科學本質』?(5分)

(3)請設計一個國中或高中的科學課程，能讓學生在學習過程中學習『科學本質』的內涵。請說明你的課程內容，並解釋此課程為何能幫助學生學習理解科學本質。(10分)

項目	子項
科學的態度與本質	培養科學探究的興趣
	養成應用科學思考與探究的習慣
	認識科學本質

三、請閱讀以下短文，說明本段短文認為『科學知識』有哪些特點。(10分)

In science, knowledge, based on evidence from many investigations, is integrated into highly developed and well-tested theories that can explain bodies of data and predict outcomes of further investigations. Although the practices used to develop scientific theories (as well as the form that those theories take) differ from one domain of science to another, all sciences share certain common features at the core of their inquiry-based and problem-solving approaches. Chief among these features is a commitment to data and evidence as the foundation for developing claims. The argumentation and analysis that relate evidence and theory are also essential features of science; scientists need to be able to examine, review, and evaluate their own knowledge and ideas and critique those of others.

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Argumentation and analysis include appraisal of data quality, modeling of theories, development of new testable questions from those models, and modification of theories and models as evidence indicates they are needed.

Finally, science is fundamentally a social enterprise, and scientific knowledge advances through collaboration and in the context of a social system with well-developed norms. Individual scientists may do much of their work independently or they may collaborate closely with colleagues. Thus, new ideas can be the product of one mind or many working together. However, the theories, models, instruments, and methods for collecting and displaying data, as well as the norms for building arguments from evidence, are developed collectively in a vast network of scientists working together over extended periods. As they carry out their research, scientists talk frequently with their colleagues, both formally and informally. They exchange emails, engage in discussions at conferences, share research techniques and analytical procedures, and present and respond to ideas via publication in journals and books. In short, scientists constitute a community whose members work together to build a body of evidence and devise and test theories. In addition, this community and its culture exist in the larger social and economic context of their place and time and are influenced by events, needs, and norms from outside science, as well as by the interests and desires of scientists.

四、名詞解釋：請說明下列名詞意義，並舉出應用實例。

- (1) 獨立樣本 t 檢定。(6 分)
- (2) 相關分析。(6 分)
- (3) 試題鑑別度。(6 分)

五、為了改善教學品質、提升學習者的科學素養，台灣已多次參與由經濟合作暨發展組織（Organization for Economic Co-operation and Development, OECD）主導的國際學生能力評量計畫（Programme for International Student Assessment, 簡稱 PISA）。PISA 提出素養的評量架構，其中包含四個相互關聯的潛在構念：情境（context）、知識（knowledge）、能力（competencies）以及態度（attitudes），並依據此架構發展評量試題。

- (1) PISA 採用『系統性抽樣』的方式在各學校抽取學生樣本以估計母體的素養能力，請問系統性抽樣的意義以及優點為何？（4 分）
- (2) PISA 採用成就測驗來評量知識構念。而態度構念方面，則是設計量表來評

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量，就你的了解，如何從量表結果來評估科學態度？(4分)

(3) PISA 2018 的測驗結果發現，台灣學生科學素養的標準差為 99，略低於 2015 年的 100，請問標準差降低的意義為何？(4分)

六、隨著十二年國教課綱的實施，高級中學新增設『自然科學探究與實作』課程。在課程中除了關注科學知識的學習外，常利用多媒體影音以及動畫模擬來進行探究與實作教學。依照國家教育研究院(2018)的探究學習內容架構表，探究歷程包含：發現問題、規劃與建議、論證與建議、表達分享。

(1) 請依據上述探究歷程的介紹，設計一套評分準則(Rubrics)，以作為評量學生探究與實作能力的標準。(12分)

(2) 動畫模擬常用來進行實作教學，你認為動畫模擬是否適用於評量探究與實作中的「實作能力」？假如你覺得適用，請舉出實際例子。如果不適用，請說明原因。(8分)