國立屏東教育大學99學年度研究所碩士班入學考試

科學文獻判讀 試題

（化學生物系碩士班 生物組與化學組）

※請注意：1.本試題共二頁。
2.答案須寫在答案卷上，否則不予計分。

問答題（共 100 分）

一、第一篇（50 分）

本文轉載自 Nature Chemical Biology

The origins of chemical biology can be traced to the enormous technological and scientific advances of the nineteenth century, resulting in the field's ascent in the twentieth century. Examining the nineteenth-century origins of chemical biology serves at least two purposes. First, the history of science provides a framework for teaching. Descriptions of classic experiments and breakthroughs can equip teachers and students with examples illustrating key concepts. Second, the historical roots of chemical biology inform us that the field has always identified exciting new research questions and challenges. Such a record promises a bright future for the field.

Nature Chemical Biology defines chemical biology as both the use of chemistry to advance a molecular understanding of biology and the harnessing of biology to advance chemistry. Despite the veneer of newness associated with the term, chemical biology has early, albeit modest, beginnings, extending back at least two centuries to the masterworks considered the foundations of chemistry and biology.

閱讀上文後，請回答下列問題：

1. 化學生物學的學門興起起源於19世紀，你覺得是哪些原因造成學門的發展？(25 分)

2. 請定義『化學生物學』。(25 分)

二、第二篇（50 分）

Nanotechnology promises to transform industries as diverse as biomedicine, computing and optics, but crafting tiny components has proved challenging. One difficulty has been finding a low-cost, durable means of moulding features smaller than 100 nanometres into the materials currently used in the manufacture of devices such as next-generation DVDs and computer chips. Silicon-based moulds used to make the latter are brittle and short-lived, and although metals would offer stronger moulds, their grains are too large to be useful at the nanoscale. For the past ten years, physicist Jan Schroers and his team at Yale University have been exploring a class of amorphous — or noncrystalline — metals called bulk metallic glasses (BMGs), which have no grain-size limit. They have now found that BMGs could serve as both the mould and the material from which nanostructures are formed, or 'imprinted' — a breakthrough that promises to revolutionize materials science. "Metallic glasses always looked like the perfect materials on paper, but no one could form them into usable structures," says Schroers. Having had no luck treating the BMGs like metals, Schroers and his colleagues pursued a different path. "Amorphous metals such as BMGs are really nothing more than extremely slow-flowing liquids. This makes them unique among metals, and permits us to process them like plastics," says Schroers. He and his team found that heating BMGs to a certain temperature caused them to soften drastically to a point at which they took on complex shapes unachievable with any other metal. However, the method still didn't allow them to create nanoscale structures. Schroers knew they needed to determine what was happening physically that was preventing these structures from forming. The team predicted that, at dimensions smaller than 100 nanometres, high surface tension creates strong capillary forces between BMG molecules. These, the team surmised, were preventing BMGs from being moulded at nanoscale dimensions. The breakthrough came when they found that the capillary forces were drastically reduced when specific BMGs were combined with the aluminium materials usually used in imprinting. This led to the discovery that combinations of certain BMGs could, in effect, allow BMGs to be used both to mould and imprint devices — provided the BMG used for the mould was stronger than that used for imprinting. Whereas previously the minimum dimensions BMGs could be moulded with were about 100 nanometres, they are now just 13 nanometres. And Schroers thinks he can make them even smaller. "Our amorphous metals should have a minimum size limitation of a single atom," he says. Schroers says that the most immediate application will be in the semiconductor industry, where it has long been hoped that nanoimprinting would replace the lithographic techniques currently used to make computer chips. These are too expensive to be commercially viable at the nanoscale because the silicon moulds are not durable enough to be cost-effective. The strength of BMGs should make nanoimprinting feasible. Schroers expects that other applications will soon follow in biomedical devices and datastorage products. "Plastics revolutionized society when they were first invented 50 years ago," he says. "I expect that will happen again as these metallic glasses combine the best of metals and plastics to eventually replace both."

閱讀上文後，請回答下列問題：

1. 由上文中可歸納得知，在材料科學的研究中，哪些面向屬於推動發展之關鍵技術？（25 分）

2. 目前以矽為基材之半導體設備有何缺失？（25 分）