

國立中山大學 104 學年度碩士暨碩士專班招生考試試題

科目名稱：科技英文【機電系碩士班乙組、戊組】

題號：438005

※本科目依簡章規定「不可以」使用計算機(混合題)

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A. Choice the Correct "One" Answer: (15%)

The concept known as the law of the instrument, Maslow's hammer, Gavel or a golden hammer is an over-reliance on a familiar tool; as Abraham Maslow said in 1966, "I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail. The first recorded statement of the concept was Abraham Kaplan's, in 1964: "I call it the law of the instrument, and it may be formulated as follows: Give a small boy a hammer, and he will find that everything he encounters needs pounding."

Maslow's hammer, popularly phrased as "if all you have is a hammer, everything looks like a nail" and variants thereof, is from Abraham Maslow's *The Psychology of Science*, published in 1966. It has also been called the law of the hammer, attributed both to Maslow and to Kaplan. The English expression "a Birmingham screwdriver" meaning a hammer, references the habit of using the one tool for all purposes, and predates both Kaplan and Maslow by at least a century. The concept has also been attributed to Mark Twain, though there is no documentation of this origin in Twain's published writings.

According to above text:

1. The instrument means (a) a golden hammer. (b) a Birmingham screwdriver. (c) a familiar tool. (d) a hammer to find a nail. (3%)
2. The law of the instrument is first stated by (a) Maslow (b) Kaplan. (c) Gaver. (d) Mark Twain. (3%)
3. The instrument is (a) a hammer one used before. (b) as a hammer for pounding nail. (c) for all purposes you can use. (d) attributed to Mark Twain. (3%)
4. Birmingham's screwdriver is (a) to be used as a common tool. (b) a tool as a hammer. (c) a nail for hammer. (d) a tool for all purposes. (3%)
5. The law of the instrument says: (a) No instrument is perfect for all purposes. (b) The law using a hammer as an instrument. (c) A hammer is a useful tool for a boy. (d) You can use one tool after your habit for everything. (3%)

B. Choice the Correct "One" Answer: (15%)

6. When you get new tires installed on your car the wheels are carefully balanced by placing small weights around the outside of the rim. If one of these weights falls off, your car may vibrate violently when you drive at certain speeds. This vibration occurs for speeds at which
 - (a) the vibration frequency of the off-balance wheel matches the frequency at which the car likes to vibrate allowing a resonant energy transfer between the two.
 - (b) the rotational kinetic energy of the wheel exactly matches the translational kinetic energy of the car, allowing a resonant energy transfer between the two.
 - (c) the vibrating wheel acts like a harmonic oscillator.
 - (d) the amplitude of the vibrating wheel becomes large enough to overcome the inertia of the massive car. (5%)
7. You are in the kitchen with three mixing bowls in front of you. One bowl is metal, the second is glass, and the third is plastic. All three are at exactly the same temperature: the 68°F(20°C) temperature of the room. If you touch the three bowls together,
 - (a) heat will flow from the glass bowl to both the plastic bowl and the metal bowl.
 - (b) heat will flow from the plastic bowl to the glass bowl, and from the glass bowl to the metal bowl.
 - (c) no heat will flow between the bowls.
 - (d) heat will flow from the metal bowl to the glass bowl, and from the glass bowl to the plastic bowl. (5%)

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8. A fan can be used to circulate air around a room. The pressure at the inlet side of the fan is
- (a) more than the pressure at the outlet side.
 - (b) less than the pressure at the outlet side but more than atmospheric pressure.
 - (c) equal to the pressure at the outlet side.
 - (d) less than the pressure at the outlet side and less than atmospheric pressure. (5%)

C. Translation the underlined sentence to Chinese: (20%)

The distinction between science, engineering and technology is not always clear. Science is the reasoned investigation or study of phenomena, aimed at discovering enduring principles among elements of the phenomenal world by employing formal techniques such as the scientific method. Technologies are not usually exclusively products of science, because they have to satisfy requirements such as utility, usability and safety. Engineering is the goal-oriented process of designing and making tools and systems to exploit natural phenomena for practical human means, often (but not always) using results and techniques from science. The development of technology may draw upon many fields of knowledge, including scientific, engineering, mathematical, linguistic, and historical knowledge, to achieve some practical result. Technology is often a consequence of science and engineering — although technology as a human activity precedes the two fields. For example, science might study the flow of electrons in electrical conductors, by using already-existing tools and knowledge. This new-found knowledge may then be used by engineers to create new tools and machines, such as semiconductors, computers, and other forms of advanced technology. In this sense, scientists and engineers may both be considered technologists; the three fields are often considered as one for the purposes of research and reference.

D. Explain the following concepts Either English or Chinese: (15%)

- 1. Velocity and speed. (3%)
- 2. Work and power. (3%)
- 3. Nano and micro machined-technology. (3%)
- 4. laminar or turbulent flow. (3%)
- 5. Material and substance. (3%)

E. Please give a brief answer in English. (35%)

- 1. You are pushing a child on a playground swing. She swings back and forth, completing one full cycle of motion every 5 seconds.
 - (a) What form(s) of energy is/are involved in the child's swinging motion? (5%)
 - (b) You want to reduce the amplitude of her swing. When during each cycle should you push her gently forward in order to reduce the size of her swing? (5%)
 - (c) How would you have to change the playground swing or the child in order to increase her period from 5 seconds to more than 5 seconds? (5%)
- 2. You are competing in a bicycle race, but have some trouble along the way.
 - (a) One of your tires develops a slow leak. As the air slowly leaks out of the tire, why does the wheel become harder to keep moving at the same speed? (6%)
 - (b) Finally you notice what is happening and stop to fix the leak. What happens to the temperature of the air inside the tire as you quickly pump it up? (6%)
 - (c) When you get back on your bike you realize that you have left it in a gear where the chain is on a small crank sprocket (the gear attached to the pedals) and a large freewheel sprocket (the gear attached to the rear wheel). Does this make it easy or difficult to start pedaling? (8%)