

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

以下五題（每題 20 分）取材自 Tom Tietenberg (2006) 所著之 *Environmental Natural Resource Economics* (seventh edition)。請詳讀摘錄之短文後，說明  
(1) 短文之主要重點，及 (2) 短文之主要資源管理觀念。

- (一) Energy from the sun drives the earth's weather and climate. Incoming rays heat the earth's surface, radiating energy back into space. Atmospheric "greenhouse" gases (water vapor, carbon dioxide, and other gases) trap some of the outgoing energy.

Without this natural "greenhouse effect," temperatures on Earth would be much lower than they are now, and life as we know it today would be impossible. It is possible, however, to have too much of a good thing. Problems arise when the concentration of greenhouse gases increases beyond normal levels, thus retaining excessive heat somewhat like a car with the windows closed in the summer.

Since the Industrial Revolution, greenhouse gas emissions have increased considerably. These increases have enhanced the heat-trapping capability of the earth's atmosphere. According to the Committee on the Science of Climate Change (2001), the earth's surface temperature has risen by about one degree Fahrenheit in the past century, with accelerated warming during the past two decades. That study concludes that most of the warming over the last 50 years is attributable to human activities.

As the earth warms, extreme heat conditions are expected to affect human health. Some damage is caused directly by the more extreme heat, as illustrated by the heat waves that resulted in thousands of deaths in Europe in the summer of 2003. Human health can also be affected by pollutants, such as smog, that are exacerbated by warmer temperatures. Rising sea levels (as warmer water expands and previous frozen sources such as glaciers melt), coupled with an increase in storm intensity, are expected to flood coastal communities. Ecosystems will be subjected to unaccustomed temperatures; some will adapt by migrating to new areas, but others may not be able to adapt in time. While these processes have already begun, they will intensify slowly throughout the century.

Climate change also has an important moral dimension. Developing countries, which contribute the least to excess greenhouse gas production, are expected to be the hardest hit due to their more limited adaptation capabilities.

Dealing with climate change will require a coordinated international response. That is a significant challenge to a world system where the nation-state reigns supreme and international organizations are relatively weak.

- (二) The United States currently imports most of its oil and its dependence on OPEC is growing. Since oil is such a strategic material, how can that vulnerability be addressed? The 2004 presidential campaign outlined two very different approaches.

President George W. Bush articulated a strategy of increasing domestic production, not only of oil, but also of natural gas and coal. His vision included opening up a portion of the Arctic National Wildlife Refuge for oil drilling. Tax incentives and subsidies were to be used to promote production.

Senator John Kerry's vision, on the other hand, promoted a much larger role for energy efficiency and energy conservation. Pointing out that expanded domestic production could exacerbate environmental problems (including climate change), he supported such strategies as mandating standards for fuel economy in automobiles and energy efficiency standards in appliances. He was strongly opposed to drilling in the Arctic National Wildlife Refuge.

Over the long run both candidates favored a transition to a greater reliance on hydrogen as an alternative fuel. Although hydrogen is a clean-burning fuel, its creation can have important environmental impacts; some hydrogen-producing processes (such as those based on coal) pollute much more than others (such as when the hydrogen is created using solar power).

(背面仍有題目,請繼續作答)

編號： 117 系所：資源工程學系丙組

科目：資源管理問題解析

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- (三) China has extremely high pollution levels that are causing considerable damage to human health. Traditional means of control have not been particularly effective. To combat this pollution, China has instituted a wide-ranging system of environmental taxation with tax rates that are quite high by historical standards.

The program involves a two-rate tax system. Lower rates are imposed on emissions below an official standard and higher rates on all emissions over that standard. The tax is expected not only to reduce pollution and the damage it causes, but also to provide needed revenue to local Environmental Protection Bureaus.

According to the World Bank (1997) this strategy makes good economic sense. Conducting detailed analyses of air pollution in two Chinese cities (Beijing and Zhengzhou) and relying on "back of the envelope" measurements of benefits, they found that the marginal cost of further abatement was significantly less than the marginal benefit for any reasonable value of human life. Indeed in Zhengzhou they found that achieving an efficient outcome (based upon an assumed value of a "statistical life" of \$8,000 per person) would require reducing current emissions by some 79%. According to their results, the current low abatement level makes sense only if China's policy-makers value the life of an average urban resident at approximately \$270. It is hard to imagine that such a low value could be justified.

Source: Robert Bohm et al. "Environmental Taxes: China's Bold Initiative," *Environment* Vol. 40, No. 7 (September 1998):10-13, 33-38; Susmita Dasgupta, Hua Wang, and David Wheeler. "Surviving Success: Policy Reform and the Future of Industrial Pollution in China" (Washington, DC: The World Bank 1997) available online at [http://www.worldbank.org/NIPR/work\\_paper/survive/china-htmp6.htm](http://www.worldbank.org/NIPR/work_paper/survive/china-htmp6.htm) (August 1998).

- (四) In its 1997 report to Congress, the EPA presented the results of its attempt to discover whether the Clean Air Act had produced positive net benefits over the period 1970 to 1990. The results suggested that the present value of benefits (using a discount rate of 5%) was \$22.2 trillion, while the costs were \$0.523 trillion. Performing the necessary subtraction reveals that the net benefits were therefore equal to \$21.7 trillion. According to this study, U.S. air pollution control policy during this period made very good economic sense.

**Monetized Benefits and Costs of the U.S. Clean Air Act, 1970-1990**  
(billions of 1990 dollars)

	1975	1980	1985	1990	Present Value
Benefits <sup>a</sup>	355	930	1,155	1,248	22,200
Costs <sup>b</sup>	14	21	25	26	523
Net Benefits	341	909	1,130	1,220	21,700

<sup>a</sup> These are the mean (average) benefits. Due to the uncertainties involved, EPA also calculated low and high estimates.

<sup>b</sup> These are the annualized costs. (Many investments in pollution control involve the purchase of durable equipment that lasts many years.) Rather than put all of the expense in the year of purchase, EPA distributed the costs over the useful lives of this equipment.

Source: Created by the author from information presented in U.S. Environmental Protection Agency, *The Benefits and Costs of the Clean Air Act, 1970 to 1990* (Washington, DC: Environmental Protection Agency, 1997): Table 18 on p. 56.

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- (五) Most of the world's chlorine is produced using one of three types of cells: the mercury cell, the diaphragm cell, and the membrane cell. Generally, the mercury-cell technology poses the highest environmental risk, with the diaphragm-cell technology posing the next highest risk.

Over the last 25 years, the mercury-cell share of the total production has fallen from 22% to 10%; the diaphragm-cell's share has fallen from 73% to 67%, and the membrane-cell's share has risen from less than 1% of the total to 20%.

What role did regulation play? One might normally expect that, prodded by regulation, chlorine manufacturers would have increasingly adopted the more environmentally benign production technique. But that is not what happened. Instead, other regulations made it beneficial for users of chlorine to switch to nonchlorine bleaches, thereby reducing the demand for chlorine. In response to this reduction in demand, a number of producers shut down, and a disproportionate share of the plants that remained open were the ones using the cleaner, membrane-cell production.

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Source: L. D. Snyder, N. H. Miller, and R. N. Stavins. "The Effects of Environmental Regulation on Technology Diffusion: The Case of Chlorine Manufacturing," *American Economic Review* Vol. 93, No. 2 (2003): 431-435.