

LIBERAL STUDIES (SCIENCE, TECHNOLOGY & SOCIETY) AS-LEVEL

1.30 pm – 4.00 pm (2½ hours)

This paper must be answered in English

1. This paper consists of **Section 1** and **Section 2**. Section 1 carries 75% of the module marks, and Section 2 carries 25%.
2. **Section 1** consists of three questions, *all* of which are to be answered. **Section 2** consists of four questions, of which candidates may attempt any *one*.
3. Each question is worth 25 marks : 18 marks are allocated for content and 7 marks for effective communication.
4. The maximum content marks are indicated in brackets at the end of each question and sub-question. They are a guide to the length of answer required, which may vary from one to several paragraphs.
5. Candidates are reminded that this subject emphasizes the ability to present and support points of view in a clear, concise and logical manner, rather than the ability to recite facts.

SECTION 1

Answer *all* the questions in this section.

1. Consider Sources A and B:

Source A

The following is a list of themes which were discussed at the International Rice Research Conference in the Philippines in 2000:

1. Ways to increase yield in irrigated rice
2. Exploitation and utilization of natural variation in rice plants
3. Breeding for tolerance to climatic factors
4. Breeding rice plants with long-lasting disease resistance
5. Managing fertilizers and pesticides in rice crops
6. Managing water supplies and weed-growth in rice seedling production
7. Impact of modern technology on food safety and on the reduction of poverty

All of these themes depend on the use of modern technology to increase rice production in order to feed the growing Asian population.

Source B

Safety of Genetically Modified (GM) Foods

The accidental introduction of a type of genetically modified maize into the human food chain is just the latest of many incidents drawing attention to GM foods. In the U.K., the findings about the safety of genetically modified potatoes led to a heated debate about the safety of GM foods. Since then, consumers have forced governments around the world to look more closely at the whole issue. In Europe, there is still considerable confusion and suspicion among the general public and the media about GM foods. After the experiences with “Mad Cow Disease”, the weight that people give to assurances from politicians, scientists and the food industry has clearly been reduced. Meanwhile, in the U.S.A., consumers seem untroubled by the issue. The divergence of opinion has created an international trade issue between governments.

- (a) State the importance to rice farmers of each of the themes listed in Source A. (7 marks)
- (b) In the light of Source B, discuss why American consumers, usually very concerned about health issues, seem untroubled by GM food concerns, while those in Europe are much more focussed upon the issue. (5 marks)
- (c) In your opinion, do the benefits of genetic modification, implied in Source A, outweigh the fears referred to in Source B? (6 marks)

2. Medical technology has advanced rapidly in the last 20 years. The following is a short list of procedures using such medical technology, and their costs:

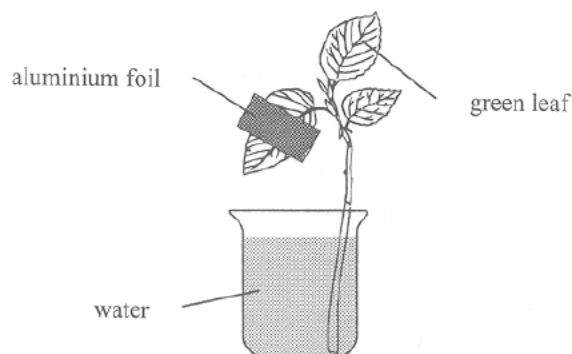
| Procedures | Costs |
|------------------------------------|---------------------|
| (a) LASIK ¹ eye surgery | US\$2,000 per eye |
| (b) Heart pacemaker implant | US\$4,200 |
| (c) Micro-surgery inside joints | US\$800 per joint |
| (d) DNA fingerprinting | US\$100 per test |
| (e) CAT ² scan | US\$500 per scan |
| (f) Kidney dialysis | US\$15,000 per year |
| (g) Heart/Lung transplantation | US\$36,000 |

1. LASIK : a kind of laser eye surgery to cure severe short-sightedness
2. CAT : Computer Aided Tomography (3 dimensional X-rays)

Government health services often bear the costs of such procedures. In America, health insurance bears the costs and many people cannot afford such insurance. Therefore they cannot receive the best medical care and, as a result, may die.

“Procedures such as (e) are for diagnosing problems, and procedures (f) and (g) are for improving the life of but not curing seriously-ill patients. These procedures cannot be justified unless patients can pay the full costs. However, procedures (a) to (d) are always justifiable because they improve the productivity of people who still have much to offer society and the procedures can return them to the workforce.” Do you agree with this viewpoint? Justify your answer. (18 marks)

3. It is known that green plants kept in fresh air and supplied with water, but also kept in the dark, die quite quickly while similar plants kept in daylight grow well. A number of identical treatments were set up to test the idea that light is responsible for a process essential to the life of plants.



After 48 hours in light, all the leaves partially covered with aluminium foil were removed and treated to various chemical tests to find out whether the covered portions of the leaves lacked certain substances which might explain why plants die if kept in the dark. The other leaves were also tested in the same way.

- (a) Explain how the procedure described above may be seen as an example of a scientific process. (9 marks)
- (b) Point out ways in which the procedure described above fails to satisfy the requirements of generally-accepted methods of scientific investigation. (4 marks)
- (c) What would you expect the scientist to do in order to check the validity of his findings? (5 marks)

SECTION 2

Answer *one* question from this section.

4. Study the following extract:

Much modern technology relies upon light and other types of electro-magnetic radiation (EMR). Most types of human needs are free, such as air for example, or inexpensive such as water and oil. However, the EMR spectrum is sold to technology providers at a high cost for “bandwidth”, for example the very high price paid recently for G3* “bandwidth” in Europe.

Below are some examples of technologies making use of EMR:

- Fibre optics
- Lasers
- Mobile telephones
- TV sets and computer monitors
- Liquid crystal displays
- Radar
- Sonar
- Body scanning
- Photography

* G3: the third generation of communication technology

Account for the low costs of most natural commodities, but the high prices charged by suppliers of communications via wireless technology, and of other modern developments of EMR-based technologies.
(18 marks)

5. The following is an extract from an article published in December 2000.

2001, the year foretold in the 1968 Clarke/Kubrick science fiction film, *2001: A Space Odyssey*.

Sir Arthur C. Clarke commented recently that he was surprised at how common personal computers had become. He also expressed surprise that, although computers can beat chess Grand Masters, they do not have any significant capability with respect to most human activities. Essentially, they remember and respond, but have no intuition or consciousness. A further surprise is that we have already surveyed robotically most of our solar system’s planets.

Based on your knowledge of the progress of science and technology in the last 20-30 years,

- (a) choose *two* scientific discoveries or technological developments that you believe will bring great benefits to humans in the next 20 years and discuss their benefits; and (9 marks)
- (b) choose *two* other discoveries or developments that you consider have caused harm to humans and discuss their harmful effects. (9 marks)

6. The National Aeronautics and Space Administration (NASA) claims that the International Space Station (ISS) will have benefits in the following areas: Exploration, Research, Business and Education. A predicted US\$3.7 billion per year will be spent on launching and maintaining the ISS.

The following are some of the research areas the ISS will promote:

- Fundamental Biology Scientists can study gravity's influence on the evolution, development, growth, and biological processes of plants and animals.
- Biotechnology A weightless environment may enable researchers to grow tissue that has more similar characteristics to tissue in the body than ever before and to produce protein crystals for use in drug development.
- Human Life Support Technology Researchers can develop technology which will enable safe and efficient human space exploration.
- Materials Science Researchers can use low gravity and low temperatures to better understand the relationships between the structure, processing and properties of materials.
- Combustion Science The reduction of gravity will allow scientists to simplify the study of complex burning processes. At present, combustion is used to produce 85 percent of the energy we use.
- Earth Science and Space Science The ISS will be a unique platform for the attachment of many instruments to better observe the Earth, its atmosphere and the universe.

- (a) Choose any **three** of the above research areas, and predict the benefits they might bring to humans. Explain your answer. (9 marks)
- (b) Suggest ways in which the benefits of the ISS might be achieved on Earth, without its huge costs. (9 marks)

7. Study the following extract:

Dragonair and other airlines, Jetfoil and other carriers, Light Rail Transit (LRT), Mass Transit Railway (MTR), Kowloon-Canton Railway (KCR), Citibus, Kowloon Motor Bus (KMB), FirstBus, Star Ferry and the Peak Tram are all essential human transport services in the Hong Kong/Guangdong region. In addition, taxis are vital means of transportation for people.

Most heavy goods deliveries rely upon road-transport and there is also a significant river-trade between Guangdong's growing industrial base and Hong Kong.

Most of the above modes of transport rely on the internal combustion engine which has an efficiency of 32% at best. On the other hand, the best electrical generators, such as those at China Light & Power's generating stations can be up to 95% efficient. These generators drive the KCR, MTR and LRT.

It has been argued that the reason for retaining the internal combustion engine as the world's preferred energy generator relates more to the oil industry's powerful control over the world's economy than to a failure of science and technology in developing better alternatives such as magnetic levitation railways or efficient fuel cells*.

* A fuel cell allows water to be separated. The hydrogen and oxygen are then combined in an explosion to produce clean energy.

- (a) Discuss whether Hong Kong has been a victim of the power of the oil industry in its transport infrastructure development. Suggest ways in which Hong Kong could have met its transport needs in a better way. (5 + 5 marks)
- (b) For years, oil-driven vehicles have been developed and improved at high cost, but today, oil-powered transport seems undesirable. Is this evidence of science fighting science? Explain your arguments. (8 marks)

END OF PAPER