

**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 emphasises 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, B and C:

### Source A

Mobile phones transmit messages in a form of non-ionising radiation. The following text is adapted from an article published by the Australian Radiation Protection and Nuclear Safety Agency of the Australian government.

Radio frequency radiation (RFR), as well as ultraviolet radiation (UV), visible light, infrared radiation (IR), and power frequency fields (from electricity cables, etc.), are all types of non-ionising radiations. These radiations, together with ionising electromagnetic radiation (e.g. X-radiation and gamma radiation) make up the electromagnetic spectrum.

When ionising radiations collide with biological material, they create positively and negatively charged particles, which may have adverse effects. Non-ionising radiations cannot create such particles.

Source: URL: [http://www.arpana.gov.au/is\\_rad.htm](http://www.arpana.gov.au/is_rad.htm).

### Source B

The text in this source is withheld due to difficulties in obtaining copyright permission from the publisher.

### Source C

Humans are constantly hit with electromagnetic radiation (EMR) from modern technology, from computer monitors and television screens, from microwave ovens and from high voltage power cables, and yet in 2001 the average life expectancy at birth of Hong Kong people was 77 years for males and 82 years for females. In 1960, it was 64 years and 71 years respectively.

- (a) Discuss the contradictions between Source A and Source B. How do you think members of the public, confronted by such controversial data, should react? (6 marks)
- (b) In your opinion, which party (governments, the cell phone industry, or individuals) has a greater responsibility in reducing the hazards mentioned in Source B? Explain your answer. (6 marks)
- (c) In view of the increase in life span of people in Hong Kong over the last forty years, can we argue that greater exposure to EMR is beneficial to a longer life span? (6 marks)

2. In Hong Kong, there is health education in primary schools and sexual reproduction is taught in Secondary 1 Integrated Science classes. There are extensive public campaigns about drug use prevention and public hygiene. It has been reported that approximately 15% of students have had sexual intercourse by the end of Secondary 3.

**Source A**

The following table represents beliefs regarding the possibility of infection from the HIV virus (which leads to AIDS) collected from about 6,000 Hong Kong students (2,842 boys and 3,252 girls) in Secondary 3 in 2001.

Is this a possible source of HIV infection?	Yes		Not Sure		No	
	Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
Injecting drug with a shared needle	44	60	25	20	31	20
Donating blood	16	20	34	34	50	46
Receiving donated blood	26	38	33	31	41	31
Using toilet seat	14	18	37	41	49	41
Heterosexual intercourse without using condom	41	18	29	41	30	41
Heterosexual intercourse using condom	19	27	34	38	47	35

Source: *Report to HKSAR Government on Youth Lifestyles in Relation to Drug Use, 2002.*

**Source B**

In the mainland of China, the most frequent modes of HIV transmission in 2001 remain sharing of contaminated needles among injecting drug users and unclean practices during blood plasma collection. However, the spread of HIV is quickly gaining speed through sexual intercourse, both heterosexual and homosexual. Underlying threats include the widespread lack of knowledge and lack of protective life skills, huge internal labour migration, underprivileged minority groups, relative poverty, youth, and gender inequity, etc.

Source: URL: <http://www.unaids.org/whatsnew/newadds/AIDSchina2001update.pdf>.

- (a) With reference to Source A, comment on the possible reasons for the gender difference reflected in most data items with regard to respondents' answers to the same question. (4 marks)
- (b) With reference to Sources A and B and in view of the differences in educational opportunity, discuss whether Hong Kong's young people seem to be in a better position to avoid HIV infection than those in the mainland of China. (8 marks)
- (c) How would you ensure that students can be more adequately protected from 'accidentally' becoming infected with the HIV virus? (6 marks)

3. Consider Sources A, B, C and D below. Sources A, B and C are adapted from an article entitled 'Green Cars Move into Top Gear' appearing on the website <http://physicsweb.org/article/world/15/7/9>.

**Source A**

Today, the USA imports more than half of its oil, and overall consumption continues to increase. By using 85% ethanol+15% petrol as a fuel (E85), U.S. drivers can help to reverse that trend. Cars using E85 can reduce pollution. Government tests have shown that E85 vehicles reduce harmful hydrocarbon and benzene emissions when compared to vehicles running on gasoline. E85 can also reduce carbon dioxide (CO<sub>2</sub>), a harmful greenhouse gas (GHG) and a major contributor to global warming.

**Source B**

Electric cars, until recently, had little commercial advantage. That has begun to change with improvements in battery technology and the introduction of new models by car manufacturers. Electric cars have obvious green advantages. They emit no pollutants and have impressive energy efficiencies. Until now, however, they have been limited by a lack of range per single electric charging and a lack of speed and acceleration.

**Source C**

Perhaps the most promising alternative vehicle technology, the one that is as close to significant commercial use as ethanol-powered cars, is the hybrid electric car. A hybrid car uses both a petrol engine and an electric motor. The idea improves fuel efficiency by allowing the electric motor to take over tasks that involve high fuel usage, such as starting the engine, rapid acceleration and climbing hills.

**Source D**

Here is a set of data comparing a conventional petrol car with a hybrid car.

	Petrol Car	Hybrid Car
Miles per gallon (city driving)	18	52
Miles per gallon (highway)	25	45
Miles per gallon (combined)	19	50
Average annual fuel cost	HK\$22,400	HK\$8,400
Base price	HK\$165,000	HK\$145,000
Annual GHG output	6.6 Tons	2.6 Tons
Passenger capacity	6	5
Engine size	4.6 litres	1.5 litres
Cylinder number	8	4
Fuel capacity	19 gallons	12 gallons
Range	350 miles	500 miles

- (a) What factors have limited fuel conservation in the car industry, technology or a combination of human and political/economic factors? Explain your answer with reference to the above sources. (9 marks)
- (b) In Hong Kong, the policies of environmental control in transport have included: restricting car sales by taxation; building better roads; and improving the rail linkages. Comment on the effectiveness of these policies and suggest more detailed and specific policies. (9 marks)

## SECTION 2

Answer *one* question from this section.

4. Electro-magnetic Radiation (EMR) might be considered essential in modern medical diagnosis. It is important in ultra-sound and X-Ray equipment, Computer Aided Tomography (CAT) scanners, Nuclear-Magnetic Resonance (NMR) Imaging and Positron Emission Tomography (PET) devices. These have allowed doctors to look with greater accuracy and depth into our bodies to discover problems. The following table shows particular uses for each of these EMR dependent devices.

Imaging Device	Cost per comparable use (HK\$)	Example of use(s)	Year of First Related Medical Use
X-Ray	400	Broken bones, lung diseases, cancerous lumps (tumours)	1895
		CAT scanners	1978
Ultra-sound	600	Foetus examination, blood flow in veins & heart	1960's
NMR Imaging	12,000	Soft tissue, tumours (nerve, tendons, liver, brain)	1977
PET	16,000	Biochemical reactions of cells to cancer, brain and heart diseases, and drugs	1970's

All of these devices save lives by detecting diseases, but lend an ever-increasing medical cost to society or to patients and their families. The same situation also occurs in many approaches to disease control.

In relation to the data above and your own attitudes and opinions, discuss the respective problems for doctors, patients and their families in deciding whether to try to detect and control a disease by using expensive technology or to give care by using alternative approaches. (18 marks)

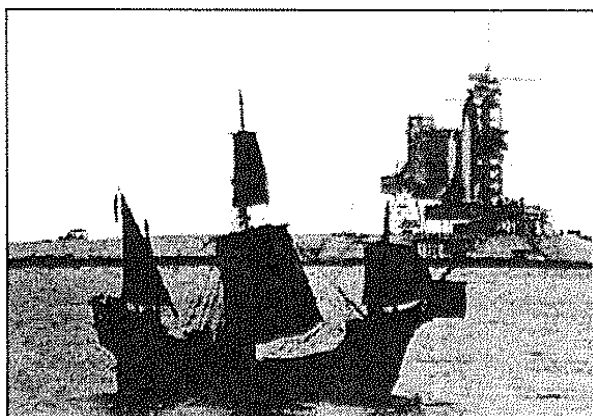
5. A dispute occurs between your country and another neighbouring country. The leaders of both countries try to resolve the dispute through diplomatic channels. Nationalism, racism, and a poor economy add fuel to the fire of this dispute. Finally, an act of terrorism touches off a war between your country and the neighbouring country. Other nations with economic ties and alliances also join the war.

The above is a typical historical example of how wars begin. The First World War and the Second World War are examples from history related to the above scenario. More recently, conflicts have occurred in Bosnia, Somalia, and the Middle East (Israel, Kuwait, and Iraq).

- (a) List *four* important scientific and technological advances which have occurred since 1940 that may be said to have resulted from, or to have been advanced rapidly by, war or the threat of war. Briefly describe each advance. (6 marks)
- (b) Choose *two* of the advances you listed in (a) and discuss their costs and benefits. Explain whether such advances have been a benefit or a burden to Hong Kong society. (12 marks)

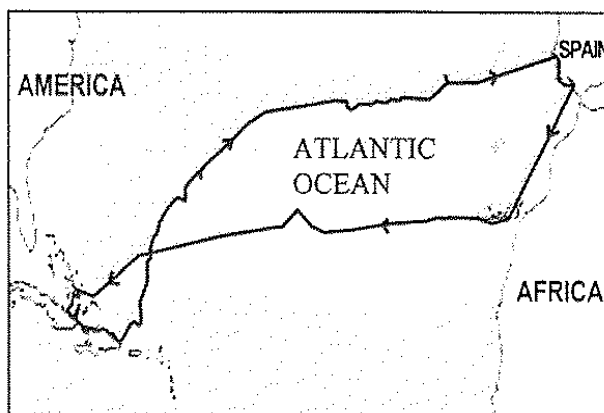
6. Consider the following pictures:

**Replica of Columbus' flagship (1492),  
in front of space-shuttle Columbia**



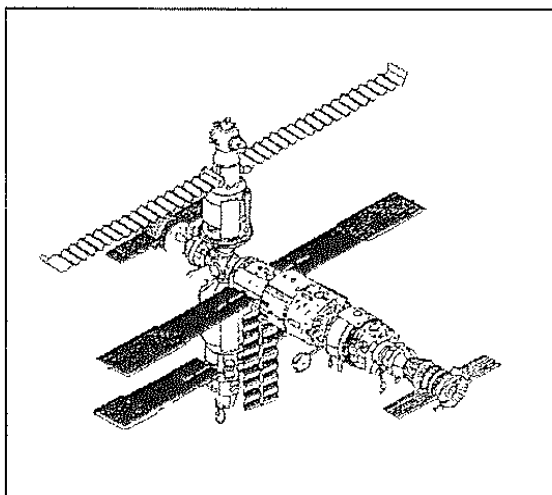
Source: URL: <http://pwg.gsfc.nasa.gov>.

**Columbus' first voyage (1492)**



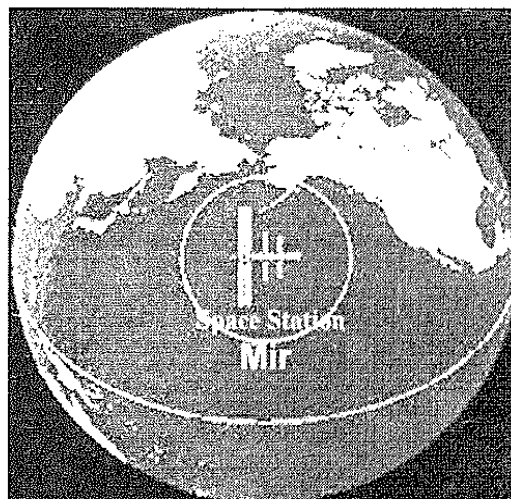
Source: URL: <http://www.jsc.nasa.gov>.

**Space Station Mir (1987)**



Source: URL: <http://pwg.gsfc.nasa.gov>.

**Mir's Daily Voyages, 1987-2002**



Source: URL: <http://pwg.gsfc.nasa.gov>.

- (a) In relation to the pictures above, list in a table some of the technological challenges facing Christopher Columbus' ocean voyages in the 15<sup>th</sup> century which would have been similar to those facing space exploration nowadays. (8 marks)
- (b) It is argued that many advances in science and technology nowadays are dependent on the attitudes of politicians and economists. How has the political situation since the ending of the Cold War affected the development of space technology in relation to manned space exploration and the International Space Station? (10 marks)

7. South African countries facing famine refused food aid from the USA unless it was certified to be free of genetically-modified organisms (GMOs). The United States Agency for International Development stressed that the food was approved by the US Environmental Protection Agency and was eaten by the US people every day.

Consider the following comments on the issue made by members of the public around the world.

- A: We've all been eating GM foods for years (some might argue for centuries), and we seem to be doing very well with it.
- B: For how long shall we keep on attempting to push the walls of nature? GMOs are a violation of natural order and the whole thing will sooner or later teach the world a lesson.
- C: The fact that the US people (some!) are consuming GMOs does not make these alien products universally acceptable.
- D: I would rather starve for a while than allow my body to be used as a laboratory.
- E: I think the real issue is the possible impact on the environment. In Canada, GMO canola plants (cooking oil is made from them) are fast becoming a super-pest (they have been made resistant to pesticides). They take over plots of land where canola has never been planted.
- F: Other GM plants can wipe out insects somewhat indiscriminately over 50 km from the plants themselves (they've been modified so that their pollen is an insecticide). Will the West pay for all the ecological damage that could follow once these GMOs get released in Africa? Not likely.
- G: For how long did Europeans eat mad cows and die before they finally made the connection? Nature takes millennia to modify and 'perfect' genes. Altering them is bound to have some unknown results.

Source: URL: [http://news.bbc.co.uk/1/hi/talking\\_point/2149638.stm](http://news.bbc.co.uk/1/hi/talking_point/2149638.stm).

Choose any **three** of the comments above. With each of the comments you choose, explain what the person who made the comment could have meant and why the person's idea is important. Explain in such a way that a Secondary 3 student might better understand those three comments and think more scientifically after reading your explanations. (6 + 6 + 6 marks)

**END OF PAPER**