

**Nature of science**  
**Standard level**  
**Paper 1**

Monday 14 May 2018 (afternoon)

Candidate session number

1 hour 30 minutes

--	--	--	--	--	--	--	--	--	--

**Instructions to candidates**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[60 marks]**.



### Section A

Answer **all** questions. For each question (1 to 5), choose the answer you consider to be the best and indicate your choice within the answer boxes provided.

- 1. What causes an electric field?  
  - A. A magnetic field
  - B. The attraction of electric charges only
  - C. The attraction or repulsion of electrical charges
  - D. The attraction and repulsion of a magnetic field
  
- 2. What can be said about particles in an atom?  
  - A. The number of protons is always equal to the number of neutrons.
  - B. The number of protons is always equal to the number of electrons.
  - C. The number of neutrons is always equal to the number of electrons.
  - D. The number of neutrons is always equal to the number of electrons and protons.
  
- 3. What is the cause of the greenhouse effect?  
  - A. The ozone layer allows infrared radiation to pass.
  - B. The Earth absorbs infrared radiation and re-radiates ultraviolet radiation.
  - C. The carbon dioxide in the Earth's atmosphere absorbs ultraviolet radiation.
  - D. Some gases in the atmosphere absorb infrared radiation emitted by the Earth.
  
- 4. Why is a DNA sequence accepted as scientific evidence for the theory of evolution?  
  - A. It allows verifiable predictions to be made about genetic relationships.
  - B. It is an accurate description of a species.
  - C. It can be used to deduce the physical characteristics of a species.
  - D. It can be used to deduce the number of nucleotides in a genome.
  
- 5. How does the current plate tectonic model represent a paradigm shift?  
  - A. The previous model was overturned as new evidence supported the current model.
  - B. The current model was adapted from the previous model to include the new evidence.
  - C. There was insufficient evidence to support the previous model.
  - D. Both models are well accepted in the scientific community.



6. Einstein's equation  $E = mc^2$  shows that mass and energy are interchangeable. The speed of light is  $3 \times 10^8 \text{ ms}^{-1}$ .

(a) Calculate the energy equivalent contained in 1 kg of mass showing your working and giving the units. [2]

.....

.....

.....

.....

(b) Outline how nuclear fission can produce large amounts of energy. [2]

.....

.....

.....

.....

(c) State why the energy released in nuclear reactions is much greater than the energy released from the burning of fossil fuels. [1]

.....

.....



7. Population and economic growth result in a high demand for raw materials.

Discuss factors in the production of raw materials.

[3]

.....

.....

.....

.....

.....

.....

.....

.....



16EP04

8. A zoonosis is a human disease caused by a pathogen originating from a non-human species.

(a) State a human disease caused by a pathogen which has crossed a species barrier. [1]

.....
-------

(b) Epidemiologists study the incidence, distribution and control of diseases. Distinguish between a correlative relationship and a causal relationship in a **named** human disease. [2]

Correlative relationship	Causal relationship

Some human diseases are influenced by environmental factors.

(c) Outline an infectious disease that has been linked to poverty. [2]

.....
.....
.....
.....

(d) Compare and contrast preventative and curative treatments. [2]

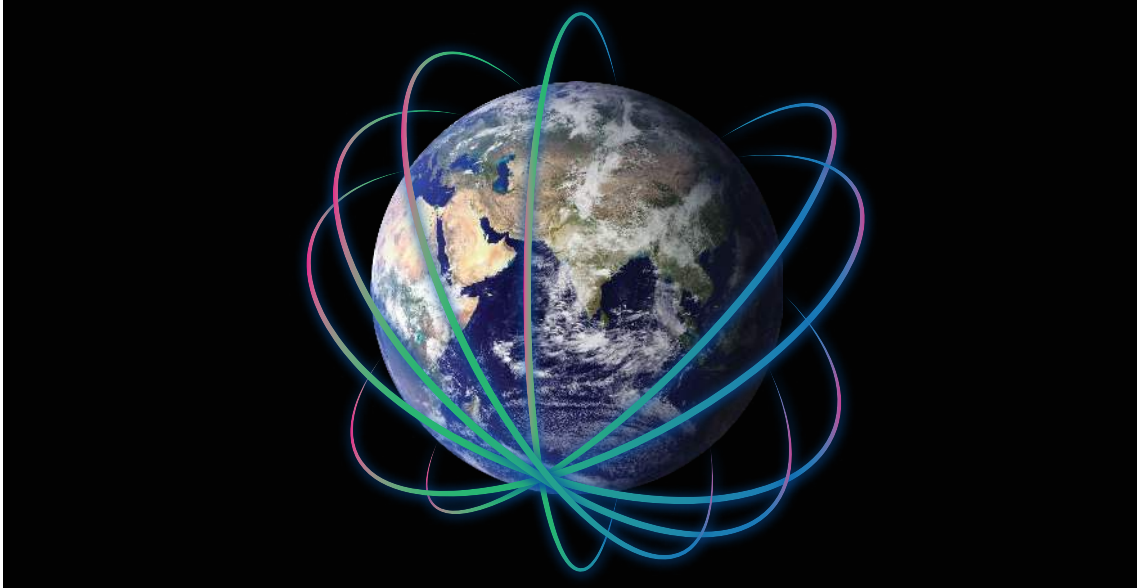
Preventative treatments	Curative treatments



### Section B

Answer **all** questions. Answers must be written within the answer boxes provided.

9. Large numbers of satellites orbit the Earth passing over polar regions at an altitude of several hundred kilometres above the Earth's surface.



[Source: adapted from [www.nasa.gov](http://www.nasa.gov)]

There are also geostationary satellites orbiting the Earth directly above the equator at an altitude of 35 786 km. This specific orbit was first suggested by the science fiction writer Arthur C Clarke in a magazine article in 1945.



[Source: <http://personal.ee.surrey.ac.uk>]

(This question continues on the following page)



16EP06

**(Question 9 continued)**

(a) Explain how satellites can orbit without using any fuel. [2]

.....  
.....  
.....  
.....

(b) Outline the significance of the geostationary satellites' altitude. [2]

.....  
.....  
.....  
.....

(c) Explain **two** advantages of geostationary satellites for television broadcasting. [2]

.....  
.....  
.....  
.....

(d) State **two** other uses for these satellites. [2]

.....  
.....  
.....  
.....

**(This question continues on page 9)**



16EP07

Turn over

Please **do not** write on this page.

Answers written on this page  
will not be marked.



16EP08



**(Question 9 continued)**

(e) Discuss the ethical issues related to the use of satellites.

[3]

.....

.....

.....

.....

.....

.....

The photograph of the earth at night was taken by satellite.



[Source: <http://svs.gsfc.nasa.gov>]

(f) Suggest how artificial light impacts the environment and how this impact can be reduced.

[3]

.....

.....

.....

.....

.....

.....

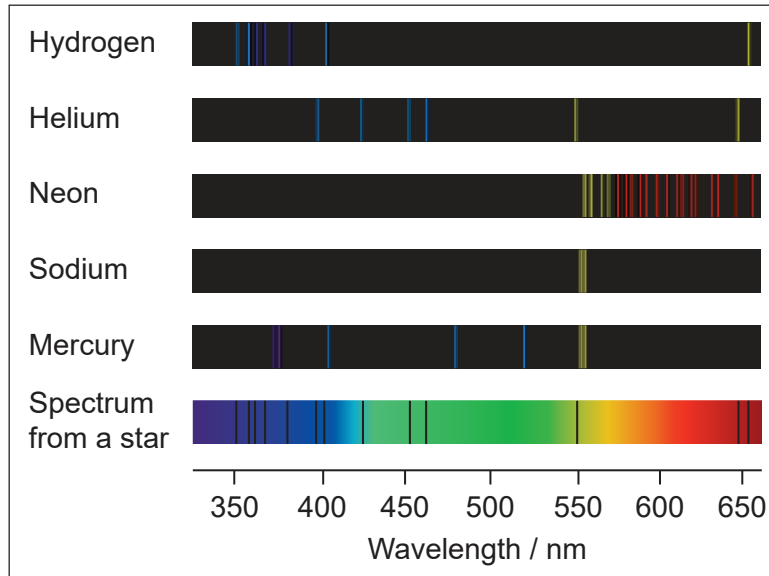


16EP09

Turn over

10. A unique spectrum can be obtained from every element.

Below are spectra from five different elements obtained in a laboratory on Earth and a spectrum obtained from a star.



[Source: International Baccalaureate Organization, 2017]

(a) List **two** technological developments that are needed to obtain star spectra. [2]

.....  
.....  
.....  
.....

(b) Outline how elements present in this star can be identified. [2]

.....  
.....  
.....  
.....

(This question continues on the following page)



(Question 10 continued)

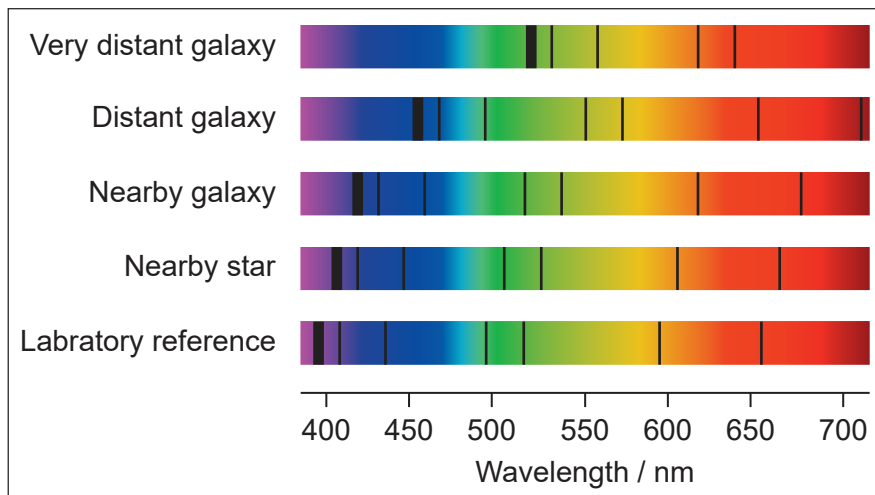
(c) Identify the elements present in the star.

[1]

.....

.....

The following diagram shows spectra from different stars and galaxies at various distances from the Earth, compared to a laboratory reference spectrum on Earth.



[Source: International Baccalaureate Organization, 2017]

The spectral lines are shifted towards the red end (longer wavelengths) of the spectra compared to the laboratory reference spectrum.

(d) Comment on what this indicates about the star and these galaxies.

[3]

.....

.....

.....

.....

.....

.....



16EP11

Turn over

11. The world's population is projected to be 9.7 billion by 2050. To feed this growing population, food production will need to increase and become more efficient.

(a) Discuss the issues concerning the use of antibiotics in animals. [3]

.....

.....

.....

.....

.....

.....

(b) Suggest how the widespread adoption of a vegetarian diet may affect food production. [3]

.....

.....

.....

.....

.....

.....

(c) Outline the issue of food wastage. [2]

.....

.....

.....

.....

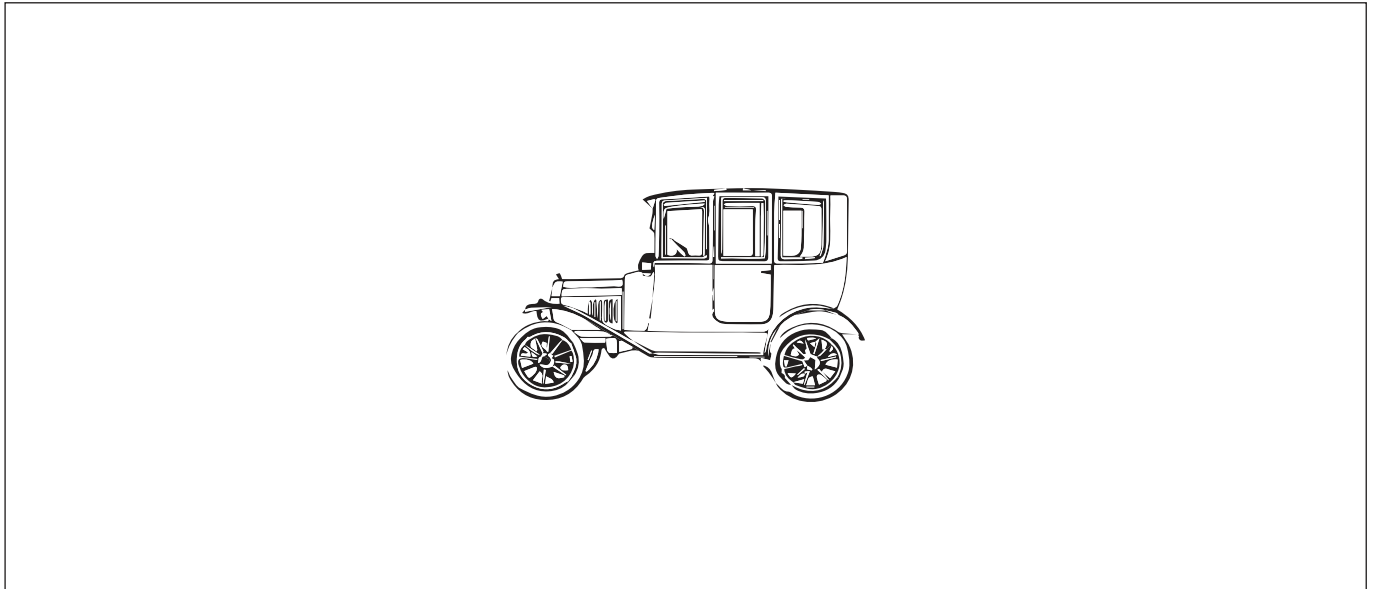


16EP12

12. Ever since Henry Ford began the mass production of cars in 1905 with the Model T Ford shown below, they have become the main mode of transport globally.

“If I had asked people what they wanted they would have said faster horses.” is attributed to Ford.

(a) On the following diagram draw the **two** horizontal forces that act on an accelerating car. [2]



[Source: adapted from <http://stlmodeltclub.org>]

(b) State how the shape of a car can increase its efficiency. [1]

.....

.....

(c) Compare and contrast the environmental impact of cars driven by internal combustion or all-electric engines. [2]

Internal combustion	All-electric

(This question continues on the following page)



16EP13

Turn over

**(Question 12 continued)**

The entrepreneur Elon Musk is building the second largest factory in the world (big enough to store 93 Boeing 747 airliners) that will produce lithium-ion batteries for powering his Tesla electric cars. When working, the factory will produce all its energy needs from solar cells.



[Source: www.businessinsider.com]

(d) Outline **one** possible environmental consequence from

(i) the construction of the factory.

[1]

.....  
.....

(ii) the manufacture and use of the lithium batteries.

[1]

.....  
.....

**(This question continues on the following page)**



16EP14

**(Question 12 continued)**

Although it has been shown that most cars are only used for two hours per day, this still has a negative effect on the environment.

(e) Suggest **three** ways in which their environmental impact can be reduced. [3]

<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
-------------------------------------------------------------------------------



16EP15

Please **do not** write on this page.

Answers written on this page  
will not be marked.



16EP16