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**ENVIRONMENTAL SYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 2**

Thursday 8 May 2014 (afternoon)

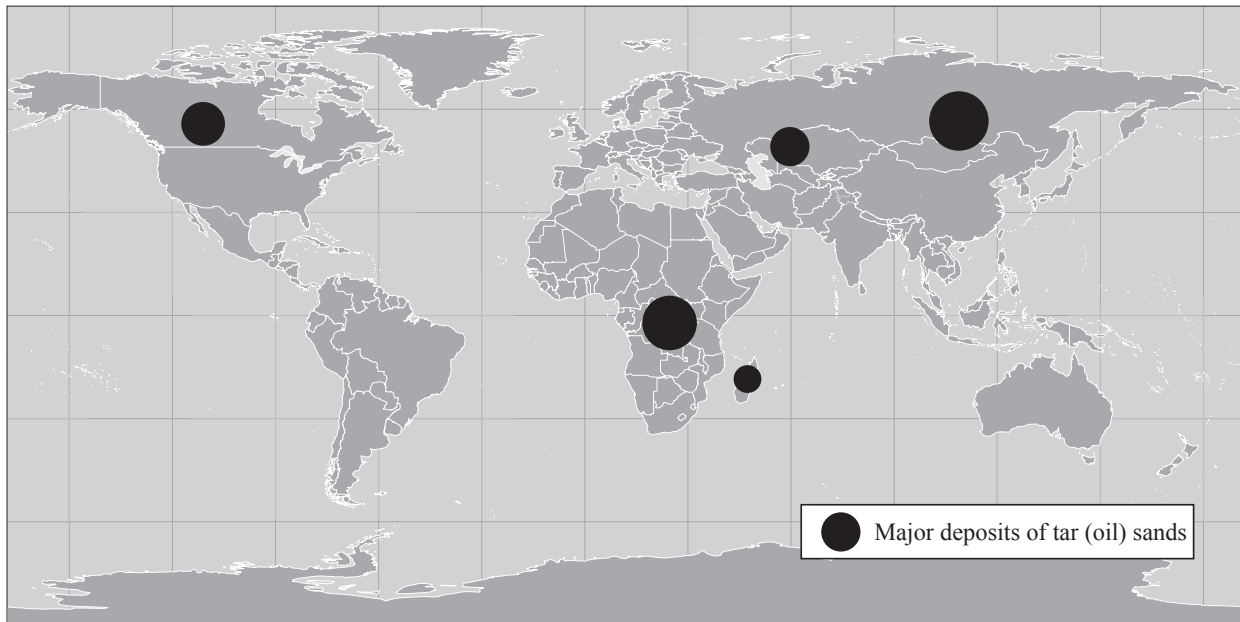
2 hours

RESOURCE BOOKLET

INSTRUCTIONS TO CANDIDATES

- Do not open this booklet until instructed to do so.
- This booklet contains **all** of the resources required to answer question 1.

Figure 1 World map showing the location of major tar (oil) sands deposits



[Source: © International Baccalaureate Organization, 2014]

Figure 2 Key facts on tar (oil) sands

What are they?

- Deposits of heavy crude oil found inside a mixture of bitumen or tar (very thick black oil), sand, clay and water.
- Too thick to flow unless heated.

Why extract now?

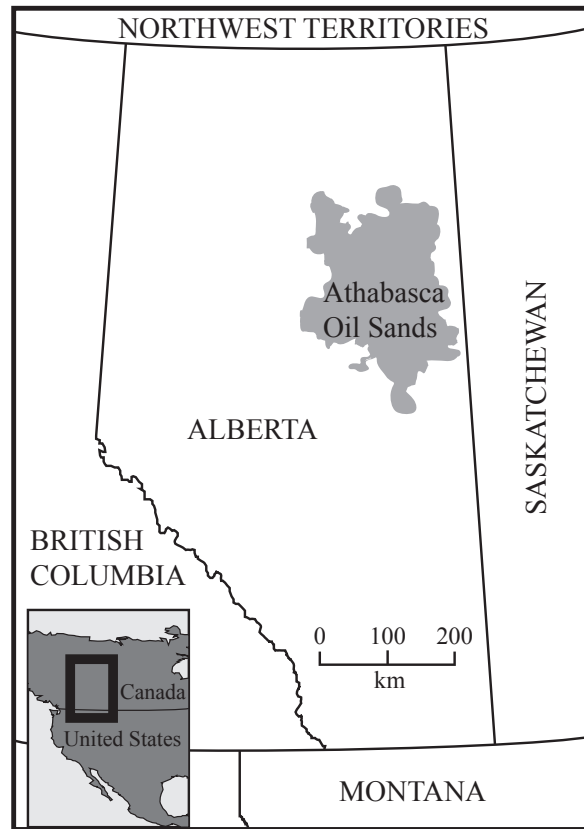
- Difficult and expensive to get out of the ground, but as oil prices increase, extraction becomes financially worthwhile.
- Extraction means Canada and USA can become self-sufficient in oil and not buy imported oil.

How are they extracted?

- Pump water from local rivers.
- Make steam from this water and pump it into the tar (oil) sands at 305°C. This makes them liquid and they are pumped to the surface.
- The mixture then has to be refined (split into different types of oil).
- Mined by strip-mining or deep pit mines.

Figure 3 Information on Canadian tar (oil) sands

(a) Location of Athabasca tar (oil) sands



[Source: © International Baccalaureate Organization, 2014]

(b) Facts on Canadian tar (oil) sands

- About 80% of the global tar (oil) sands deposits are found in Alberta province, Canada, most in the Athabasca field.
- There are potentially 1350 billion barrels of oil – more oil than used by humans to date.
- This is the second largest reserve of oil after Saudi Arabia.
- About 10% could be extractable.
- The extraction of the oil is the largest capital project on Earth at the moment.
- The Keystone XL pipeline is a 3500km long pipeline carrying crude oil from the Athabasca tar sands southwards to oil refineries in the USA. Extensions to the pipeline could reach Houston in Texas. The pipe is buried no less than 1.3 m deep. An extension of the pipeline may go over the Ogallala Aquifer, one of the largest reserves of fresh water on Earth that provides drinking water to 2 million people.

Figure 4 Photographs of habitat and mining in Alberta

(a) Boreal forest or Taiga

Coniferous tree biome with lynx, snowshoe hare, lemmings, voles, red squirrel, moose, red deer, beaver



[Source: © Greenpeace / Richard Brooks]

(b) Muskeg habitat

Low-lying marsh or peat bog, water table near surface, beavers' habitat, permafrost below



[Source: http://en.wikipedia.org/wiki/File:Wrangell_Muskeg.JPG]

(c) Mining of tar (oil) sands



[Source: www.earthobservatory.nasa.gov/IOTD/view.php?id=40997
© NASA]

Figure 5 The case for and against mining tar (oil) sands

Exploitation of the Athabasca tar (oil) sands is controversial.

Opponents of the industry say that:

- It produces three times more greenhouse gas emissions than burning conventional fossil fuels.
- Fossil fuels are burned to heat the water to steam to extract tar sands.
- Underground carbon stores become available.
- Oil produced is burned.
- Boreal forest is cut down so releasing another carbon store.
- Wildlife is displaced or dies.
- Only 10% of water taken from the Athabasca River is returned.
- Fresh water supplies are polluted by toxic waste in ponds that leak into the river and groundwater (estimate of 11 million litres per day).
- Indigenous people (first nations) may be displaced and may have increased rates of rare forms of cancer.

[Source: www.wwf.org.uk/what_we_do/changing_the_way_we_live/oilsands.cfm
Figures courtesy of WWF (panda.org). Some rights reserved.]

Supporters of the industry say that :

(a)

- Tar (oil) sands are a secure source of energy for Canada and the USA (enabling energy security).
- In 2009 Canada was the largest supplier of crude oil to the USA.
- The Keystone XL pipeline development will create jobs.
- It will provide additional 300 000 jobs in USA.
- Companies reinvest in Carbon Capture and Storage (CSS) technology that will mitigate carbon emissions.
- 7.5 million trees have already been replanted to restore forest.

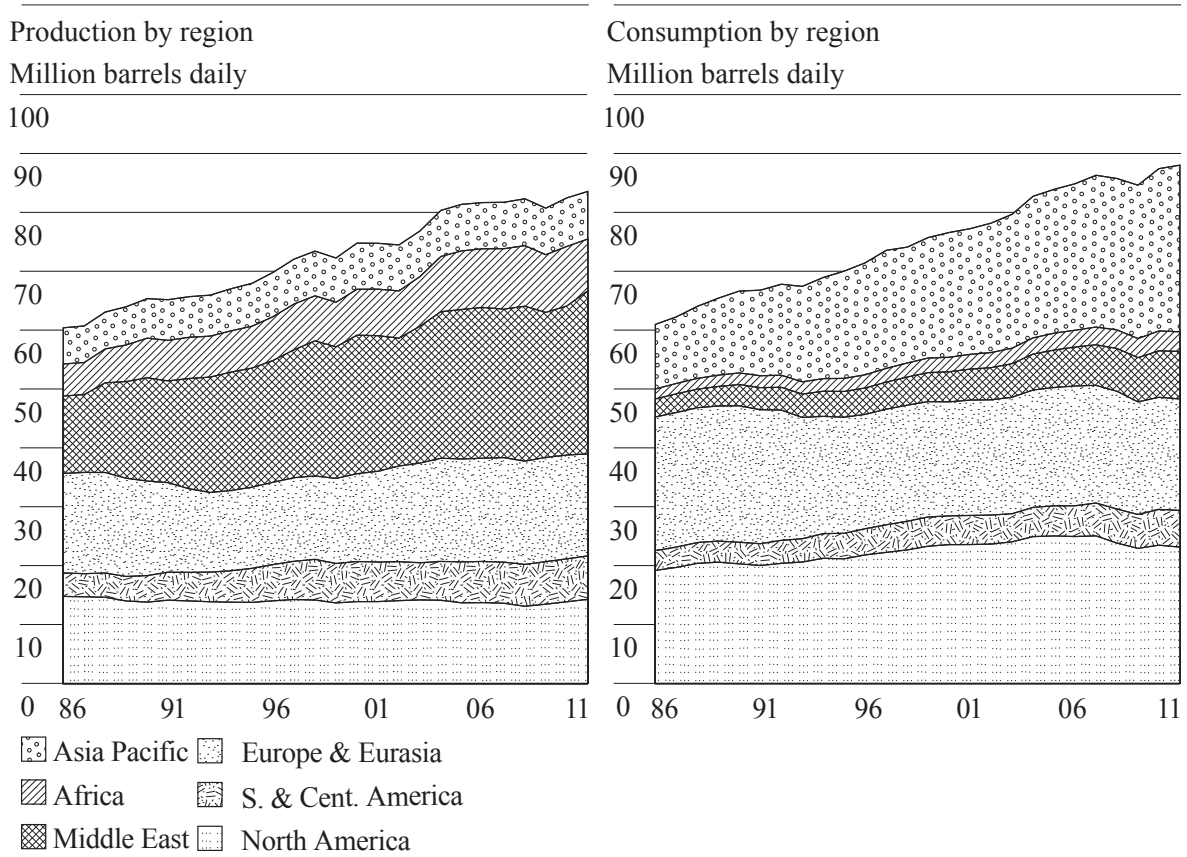
[Source: www.politico.com/news/stories/0710/39836.html]

(b)

*“A good neighbor lends you a cup of sugar.
A great neighbor supplies you with 1.4 million barrels of oil per day.”*

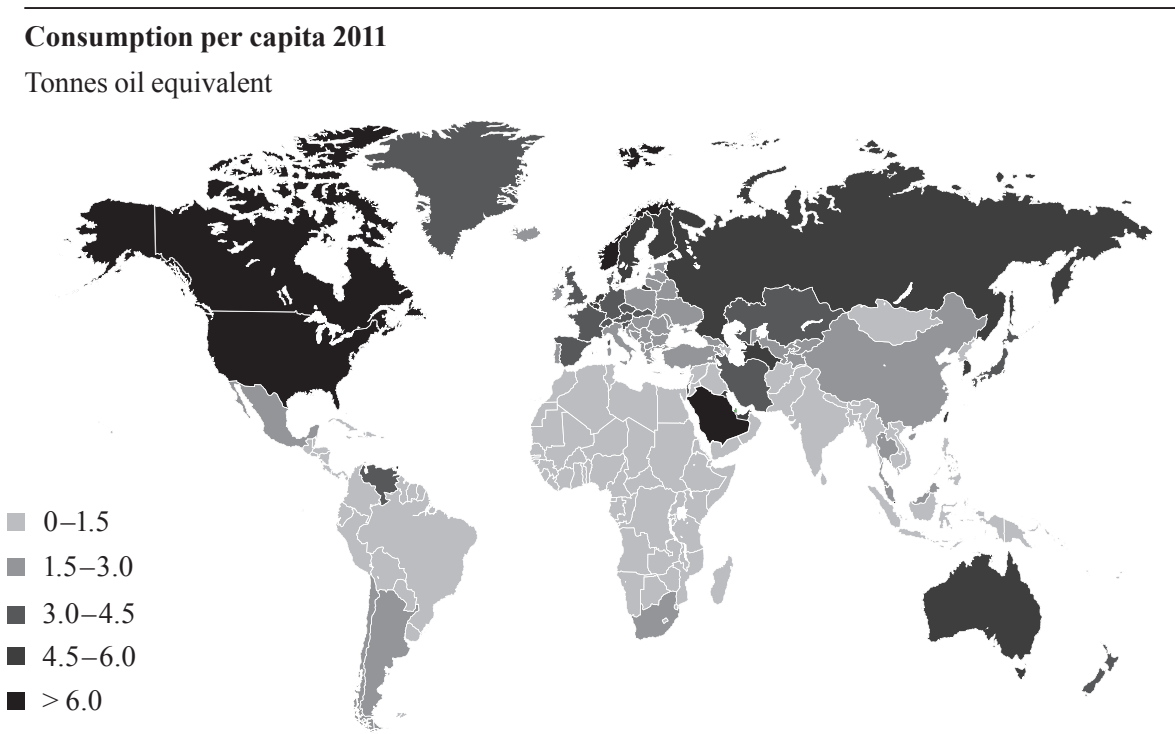
–Ed Stelmach July 2010

Figure 6 Oil production and consumption by world region (1986–2011)



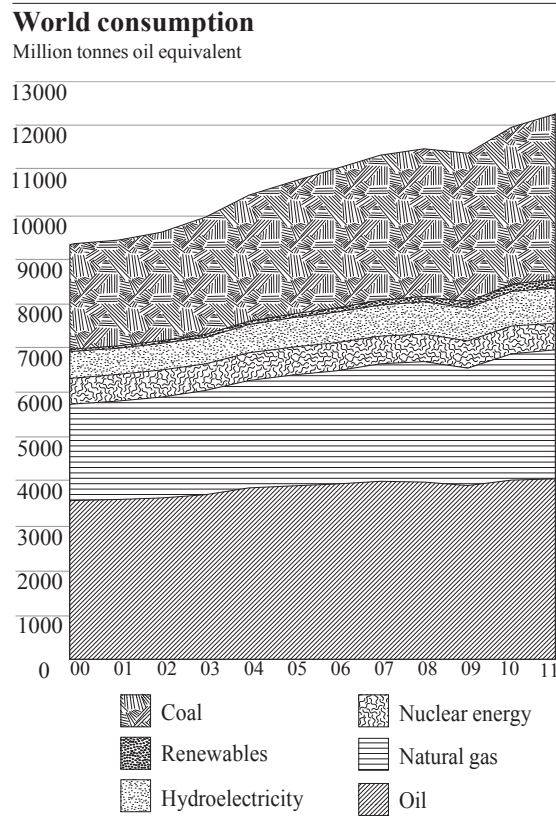
[Source: adapted from www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2012.pdf
BP Stats Review data used with permission.]

Figure 7 Oil equivalent consumption per capita in 2011



[Source: adapted from www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2012.pdf
BP Stats Review data used with permission.]

Figure 8 World consumption of oil equivalent by type of fuel (2000 – 2011)



[Source: adapted from www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2012.pdf
BP Stats Review data used with permission.]

Figure 9

Writer A

Infrastructure for mining projects have cleared 30 000 ha of forest and 300 000 ha more could be cleared in future mining.

“This is the largest single industry emitting carbon dioxide on Earth – 0.1 % total global emissions”

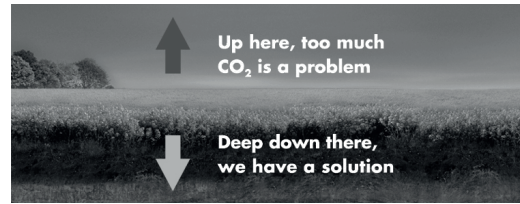


[Source: UK Tar Sands Network. www.no-tar-sands.org.
Used with permission.]

Writer B

Surface mining has affected 0.1 % of Canada’s boreal forest.

“The total greenhouse gas emissions from all Alberta’s oil sands projects account for less than one-tenth of one percent of global greenhouse gas emissions.”



[Source: Adapted from <http://www.shell.ca/en/aboutshell/our-business-tpkg/upstream/oil-sands/quest.html>]



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**ENVIRONMENTAL SYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 1**

Candidate session number

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Wednesday 6 November 2013 (morning)

Examination code

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1 hour

INSTRUCTIONS TO CANDIDATES

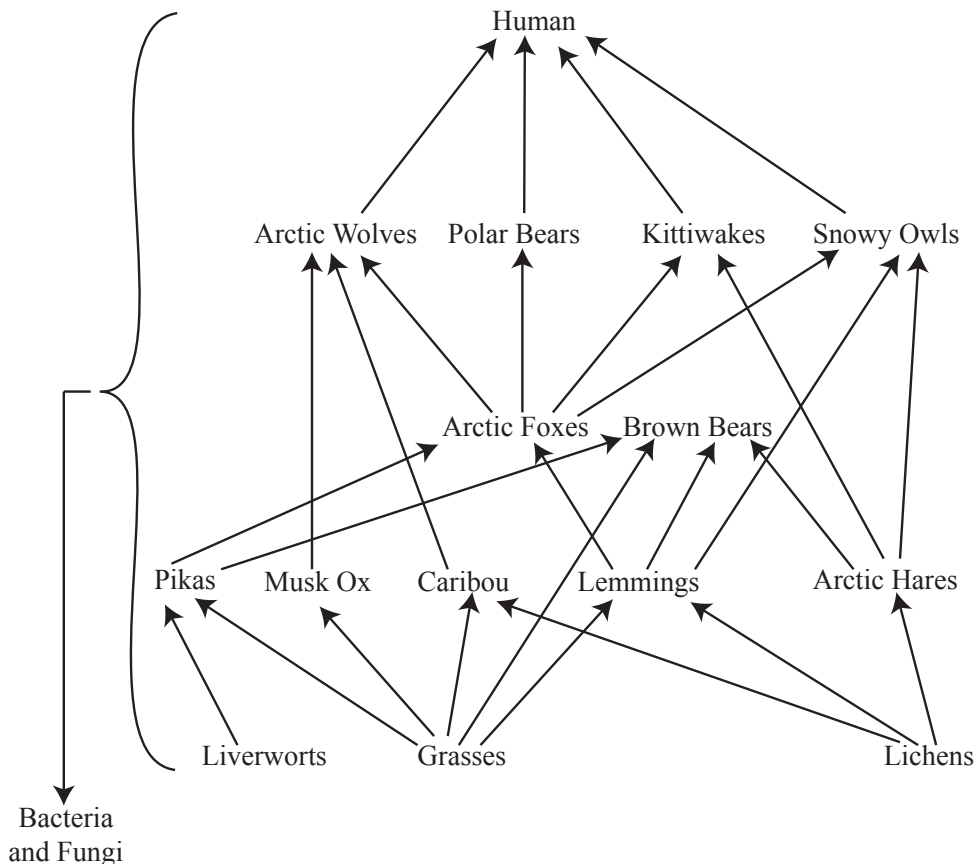
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[45 marks]*.



16EP01

1. Figure 1 below shows a food web for an ecosystem within a Tundra biome.

Figure 1



[Source: http://biomesfirst.wikispaces.com/file/view/Food_Web.JPG]

(a) Define the term *biome*.

[1]

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(Question 1 continued)

(b) Identify **two** abiotic factors that affect the distribution of tundra. [1]

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(c) (i) With reference to Figure 1, state the ecological relationship between two **named** species. [1]

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(ii) State the trophic level of the Arctic foxes in this food web. [1]

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(iii) A food web is a model. Explain one strength and one weakness of this model. [2]

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2. Figure 2 below shows a table of demographic data for four countries around the world.

Figure 2

	Total fertility rate/average number of children per woman in her lifetime	Crude birth rate/thousand population	Crude death rate/thousand population	Natural increase %	Doubling time
Country A	1.4	9	9	0	n/a
Country B	7.0	48	12	X	19
Country C	2.0	13	8	0.5	Y
Country D	2.9	24	5	1.8	39

(a) (i) With reference to Figure 2, determine the values of X and Y. [2]

X.
Y.

(ii) Suggest **two** reasons for the difference in total fertility rate between Country B and Country C. [2]

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(iii) State the stage of demographic transition for Country D. [1]

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(Question 2 continued)

- (b) (i) Describe how an ecological footprint of a population is calculated. [2]

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- (ii) Outline the relationship between ecological footprint and stage of demographic transition. [1]

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- (iii) Comment on the statement “vegetarians have a smaller ecological footprint”. [2]

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(Question 2 continued)

(c) Suggest how recycling can reduce the ecological footprint of a school.

[3]

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Answers written on this page
will not be marked.

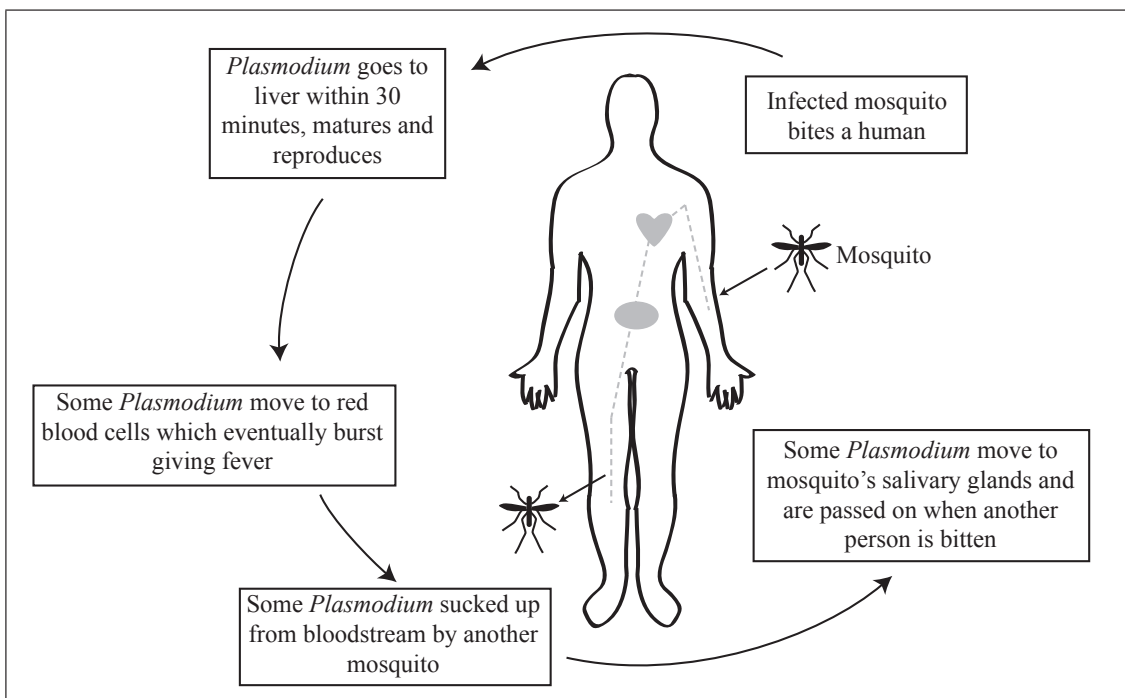


16EP07

Turn over

3. Figure 3 below shows the life cycle of the malaria protozoan *Plasmodium*.

Figure 3



[Source: 'Life cycle of the malaria protozoan *Plasmodium*' from *Geofile Online*, September 2007, issue 553 by Barbara Melbourne. Published by Nelson Thornes 2007.]

(a) (i) With reference to Figure 3, state the type of population interaction between humans and mosquitoes. [1]

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Malarial mosquitoes can be controlled by using pesticides, for example DDT.

(ii) Identify **one** economic benefit of controlling malarial mosquitoes. [1]

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(Question 3 continued)

(iii) State **two** arguments for conserving mosquitoes. [2]

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(iv) Outline how global warming could change the area of distribution of the mosquitoes that carry malaria. [2]

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(b) The publication of *Silent Spring* by Rachel Carson led to a change in the methods used to control mosquitoes and other insect pests, including in agriculture. Describe **one** other major influence **or** event that has changed attitudes to the environment. [2]

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4. (a) Explain how a **named** indicator organism could be used to detect pollution in an area. [3]

Name of indicator organism:

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Explanation:

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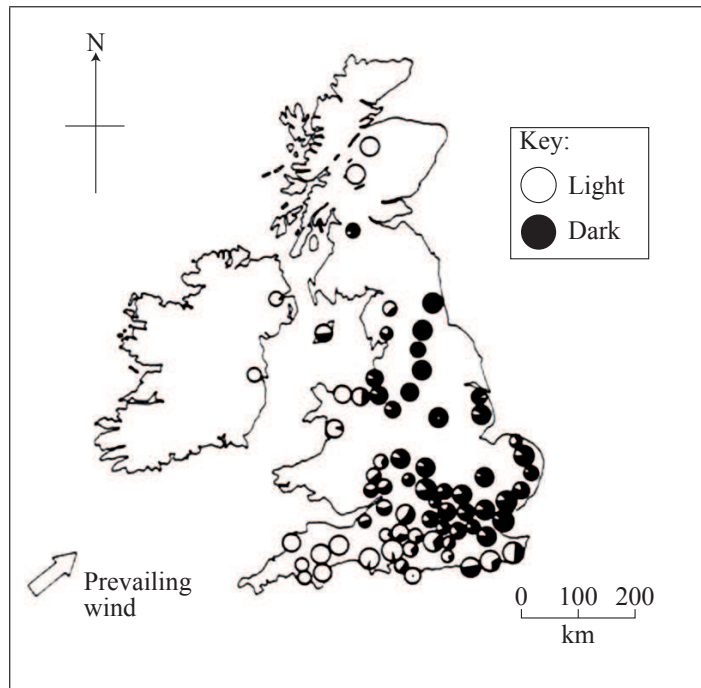
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Figure 4 below shows the distribution of two forms of peppered moths in woodlands of the UK in the 1950s. At the time, surfaces of most trees in Central and South Eastern England were heavily blackened with deposits of carbon from local coal burning. There are two forms of the moth, dark and light, and both may be eaten by woodland birds.

Figure 4



[Source: © International Baccalaureate Organization 2014]

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16EP10