



22116301

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

Monday 23 May 2011 (morning)

1 hour

Candidate session number

0	0							
---	---	--	--	--	--	--	--	--

Examination code

2	2	1	1	–	6	3	0	1
---	---	---	---	---	---	---	---	---

INSTRUCTIONS TO CANDIDATES

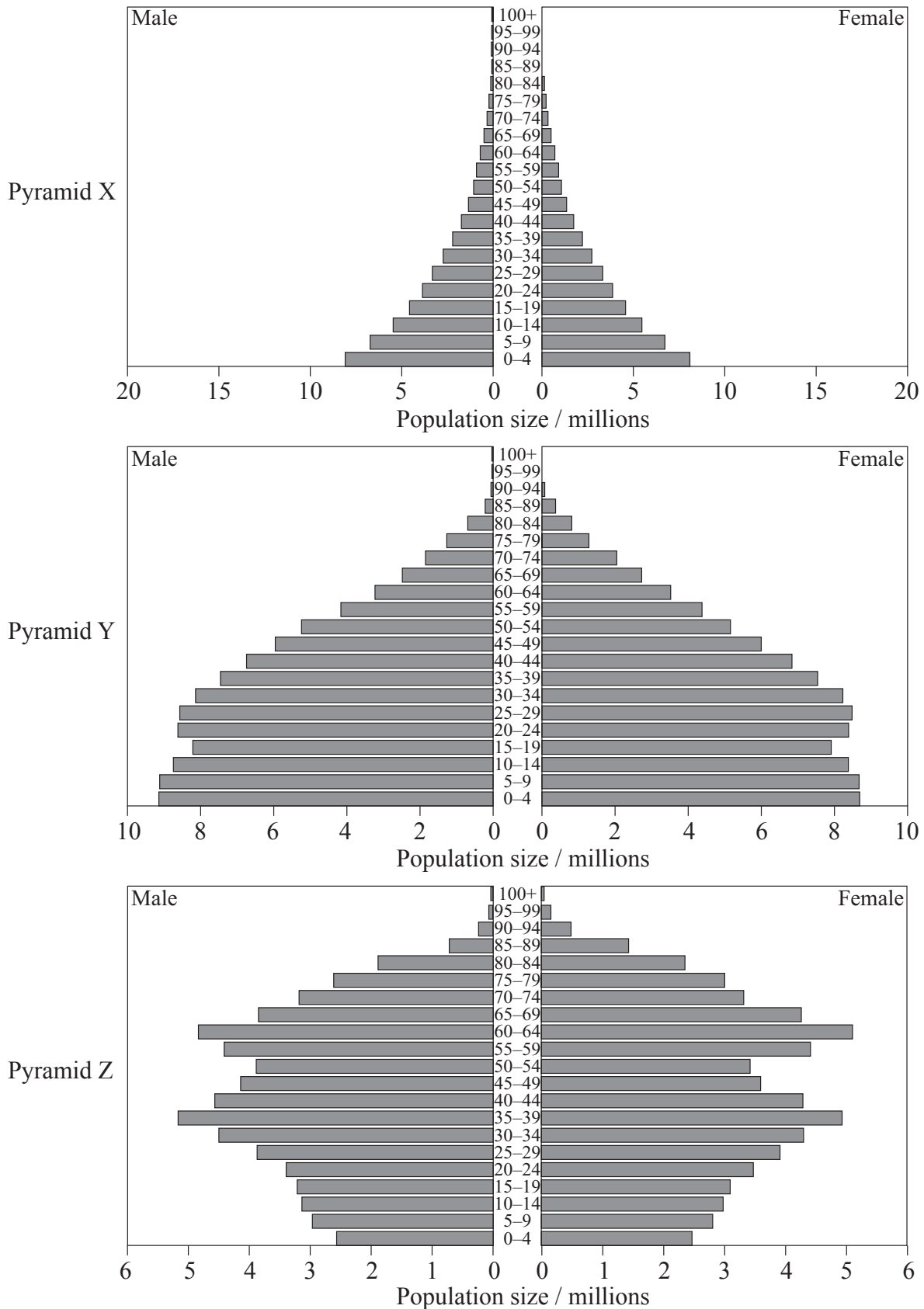
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Write your answers in the boxes provided.



0120

1. Figure 1 below shows age/sex pyramids (X, Y and Z) for three different countries in the year 2010.

Figure 1



[Source: www.census.gov/ipc/www/idb/pyramids.html]

(This question continues on the following page)



(Question 1 continued)

- (a) State which pyramid (X, Y or Z) represents each of the following countries. [1]

Brazil:
Ethiopia:
Japan:

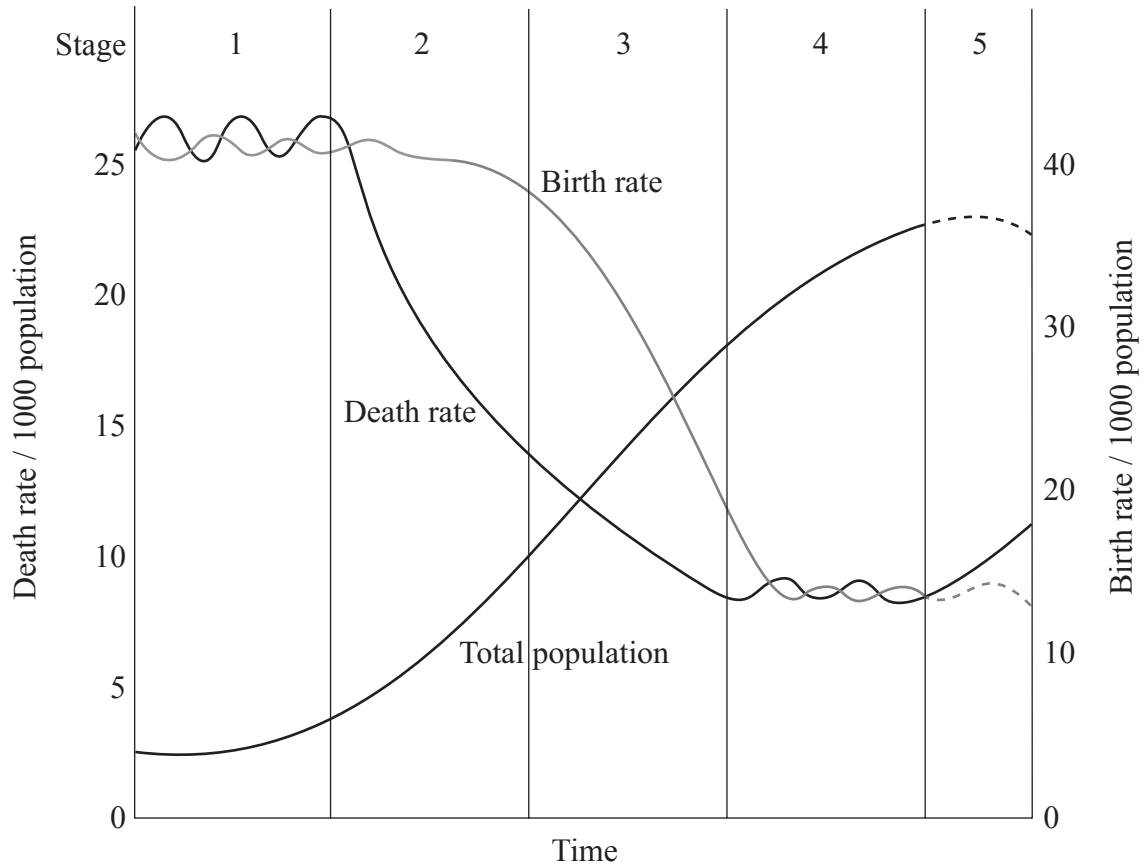
(This question continues on the following page)



(Question 1 continued)

Figure 2 below shows the demographic transition model.

Figure 2



[Source: [http://i.ehow.com/images/GlobalPhoto/Articles/2243559/Demographic TransitionModel-mail Full.jpg](http://i.ehow.com/images/GlobalPhoto/Articles/2243559/Demographic%20TransitionModel-mail%20Full.jpg)]

- (b) Identify the stage of demographic transition in which you would expect to find each pyramid in Figure 1. [1]

Pyramid X:

Pyramid Y:

Pyramid Z:

(This question continues on the following page)



(Question 1 continued)

- (c) Define the term *ecological footprint*. [1]

.....

.....

- (d) State how the ecological footprints of a country in stage 1 and a country in stage 4 of the demographic transition model (Figure 2) would differ. [1]

.....

.....

- (e) Explain **three** reasons for the difference in ecological footprints you have identified in part (d). [3]

.....

.....

.....

.....

.....

.....

- (f) Evaluate the concept of an ecological footprint as a way of measuring resource use. [2]

.....

.....

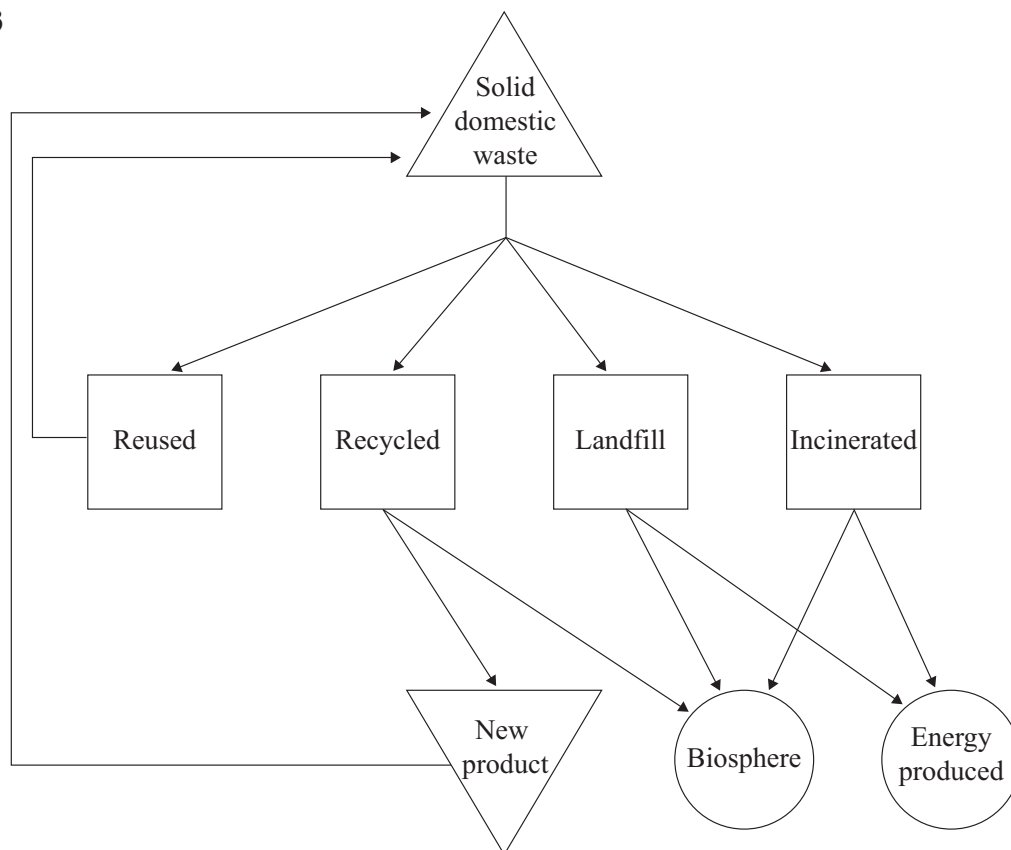
.....

.....



2. Figure 3 below is a model showing possible routes for solid domestic waste.

Figure 3



- (a) State **one** advantage and **one** disadvantage of each of the following methods of solid waste disposal.

[3]

	Advantage	Disadvantage
Recycling
Landfill
Incineration

(This question continues on the following page)



(Question 2 continued)

- (b) Identify **one** other method of solid waste disposal and state the name of a material that is managed in this way. [1]

<p>Method of solid waste disposal:</p> <p>.....</p> <p>Material managed in this way:</p> <p>.....</p>

- (c) Outline **two** factors at the national scale which affect the choice of waste disposal method. [2]

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

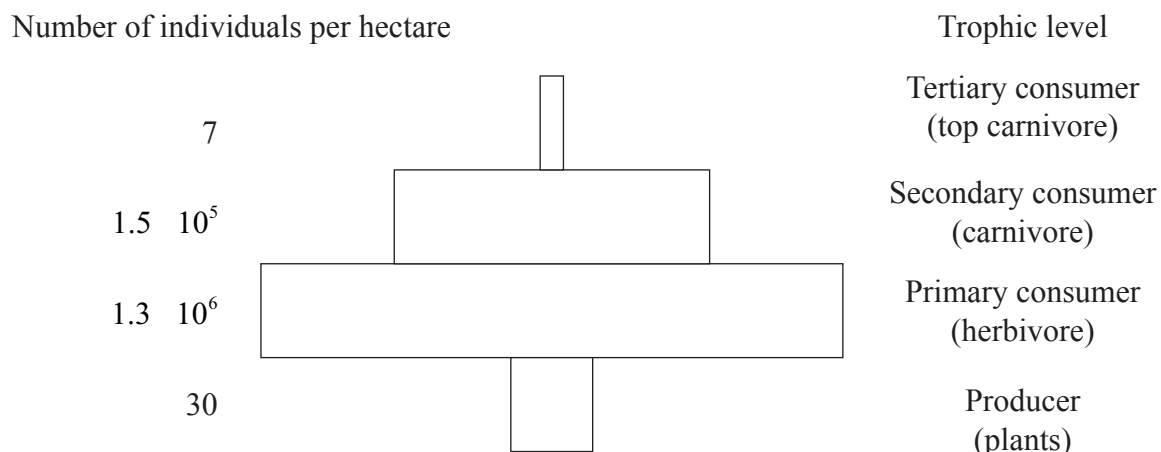
- (d) Explain how the use of waste to generate energy can increase greenhouse gases in the atmosphere. [2]

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



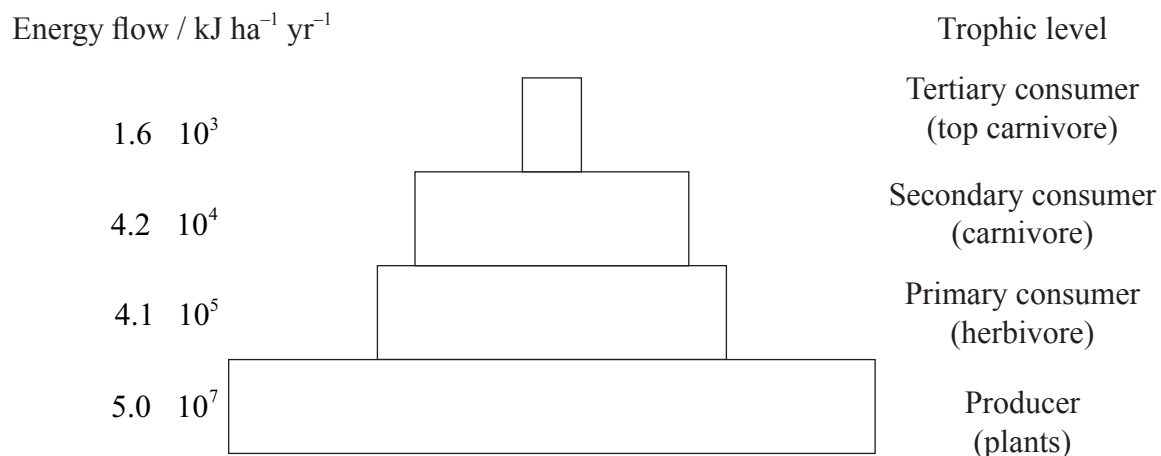
3. Figure 4(a) below shows a pyramid of numbers and Figure 4(b) shows a pyramid of productivity (both in log scale) for a temperate deciduous woodland ecosystem.

Figure 4(a)



J.L. Chapman and M.J. Reiss, Ecology: Principles and Applications, 2nd ed., 1998,
© Cambridge University Press. Used with permission.

Figure 4(b)



[Source: adapted from Chapman J. L. and Reiss M. J. (1999) Ecology: Principles and applications, CUP]

- (a) Explain why the pyramid of numbers in Figure 4(a) has fewer producers than consumers. [1]

(This question continues on the following page)



(Question 3 continued)

- (b) For an ecosystem you have studied, draw a food chain of at least **four** named species. [1]

- (c) State **one** other type of pyramid used to show trophic levels. [1]

.....

- (d) Evaluate pyramids of numbers as a method of representing the biotic components of an ecosystem. [2]

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

(This question continues on the following page)



(Question 3 continued)

- (e) Describe **two** ways in which the pyramid structure of an ecosystem may be changed by a **named** human activity. [2]

Human activity	How pyramid structure is changed
1.
2.



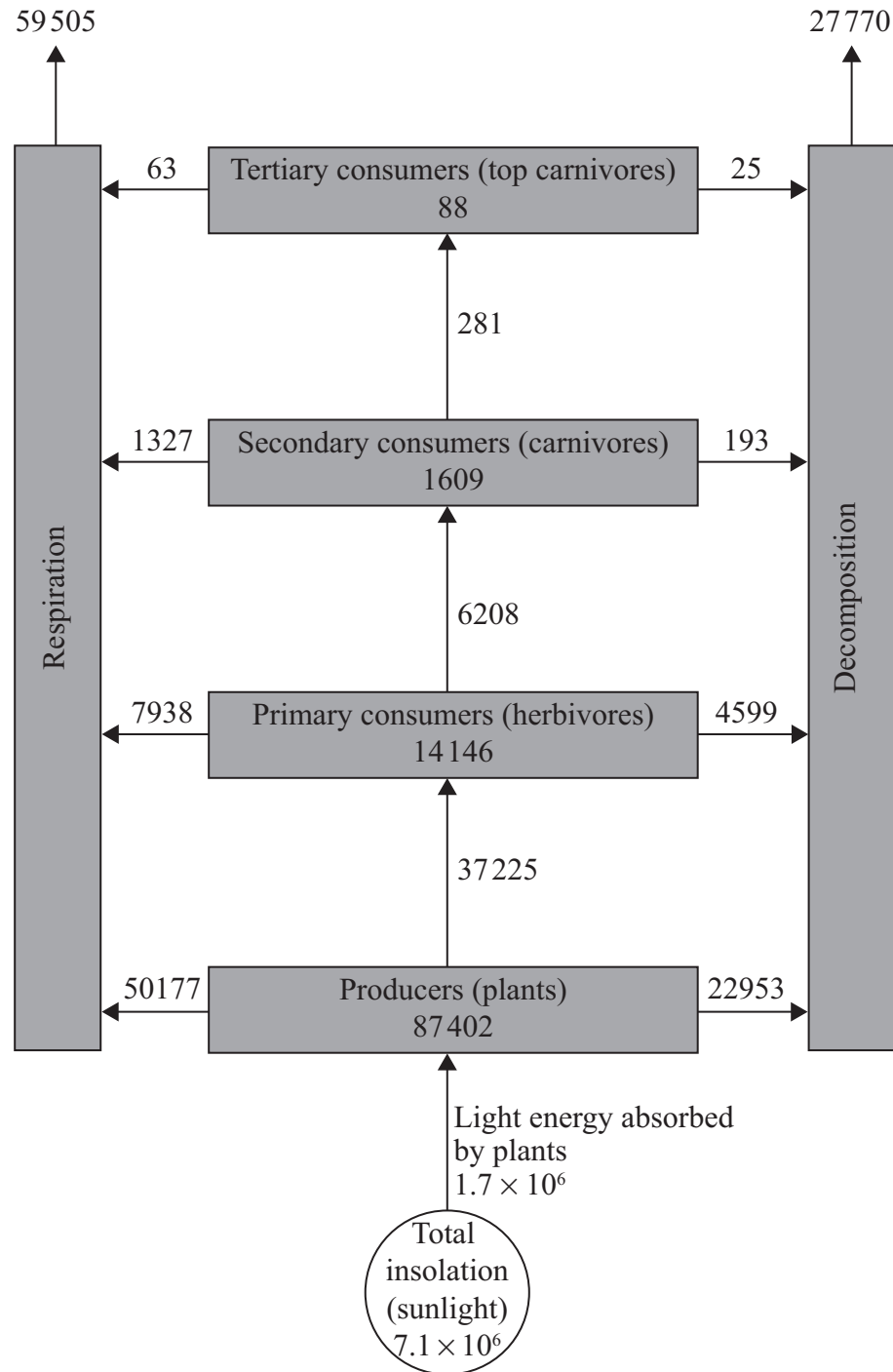
Please **do not** write on this page.

Answers written on this page will
not be marked.



4. Figure 5 below shows the flow of energy through a freshwater ecosystem in Florida, USA. The figures are given in kilojoules per square metre per year ($\text{kJ m}^{-2} \text{yr}^{-1}$).

Figure 5



[Source: adapted from Odum H. T. (1985) Silver Springs Study in Ecology, ABAL series, CUP]

(This question continues on the following page)



(Question 4 continued)

- (a) Define the term *net primary productivity* (NPP). [1]

.....

.....

- (b) Define the term *gross secondary productivity* (GSP). [1]

.....

.....

- (c) Calculate the efficiency of conversion of total insolation (sunlight) to NPP in Figure 5. [1]

.....

.....

- (d) List **four** possible reasons why not all sunlight emitted by the sun is used by plants for photosynthesis. [2]

.....

.....

.....

.....

(This question continues on the following page)



(Question 4 continued)

- (e) Explain, giving **two** reasons, why the net productivity of secondary consumers is much smaller than that of primary consumers. [2]

.....

.....

.....

.....

- (f) Compare the energy efficiency of terrestrial and aquatic food production systems. [2]

.....

.....

.....

.....



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

Answers written on this page will
not be marked.



1520

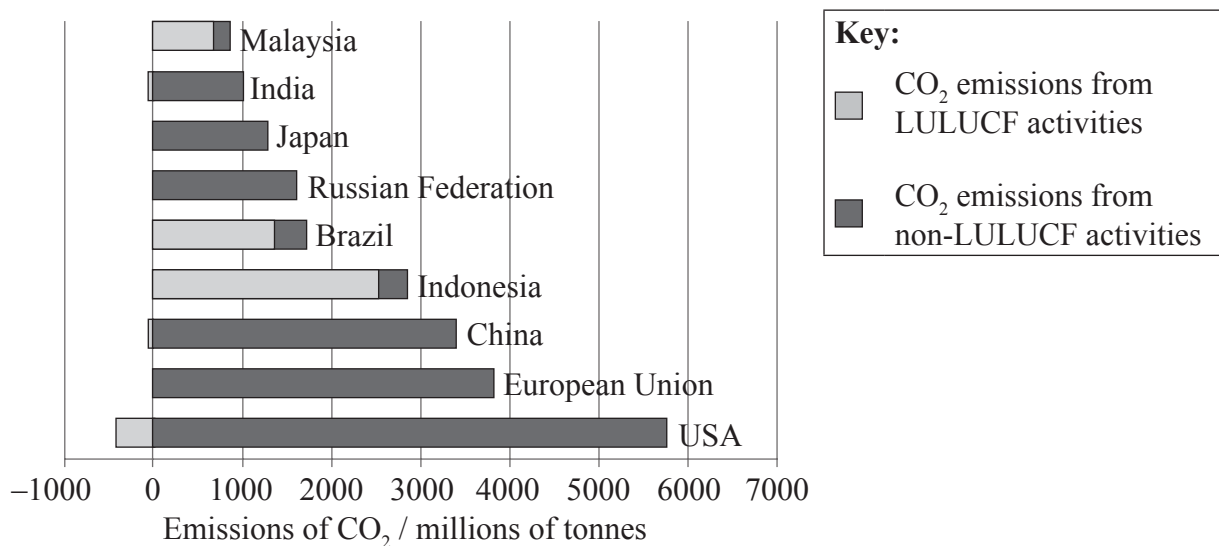
Turn over

5. Land use, land use change and forestry (LULUCF) and non-LULUCF activities affect the global carbon cycle. These activities add or remove carbon dioxide (CO₂) from the atmosphere.

- LULUCF activities: the conversion of forest to agricultural land, the logging of forests or the conversion of natural ecosystems to permanent croplands.
- Non-LULUCF activities: the combustion of fossil fuels, transport and industry.

Figure 6 below shows emissions of CO₂ from LULUCF and non-LULUCF activities in various countries and regions of the world in the year 2000.

Figure 6



Adapted from C. Davies (2008), Protecting Forests to Save the Climate: REDD Challenges and Opportunities on <http://earthtrends.wri.org/updates/node/303>. Figure 1. Source: EarthTrends, 2008; using data from the Climate Analysis Indicators Tool, 2008.

(a) With reference to the data in Figure 6,

- (i) state which country has the highest **total** CO₂ emissions and which country has the highest CO₂ emissions from LULUCF. [1]

Highest total CO₂ emissions:

.....

Highest CO₂ emissions from LULUCF:

.....

(This question continues on the following page)



(Question 5 continued)

- (ii) explain why the emissions from LULUCF activities represent such a high proportion of CO₂ emissions in some countries. [2]

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

- (iii) state why the USA has a negative value for emissions from LULUCF activities. [1]

.....
.....

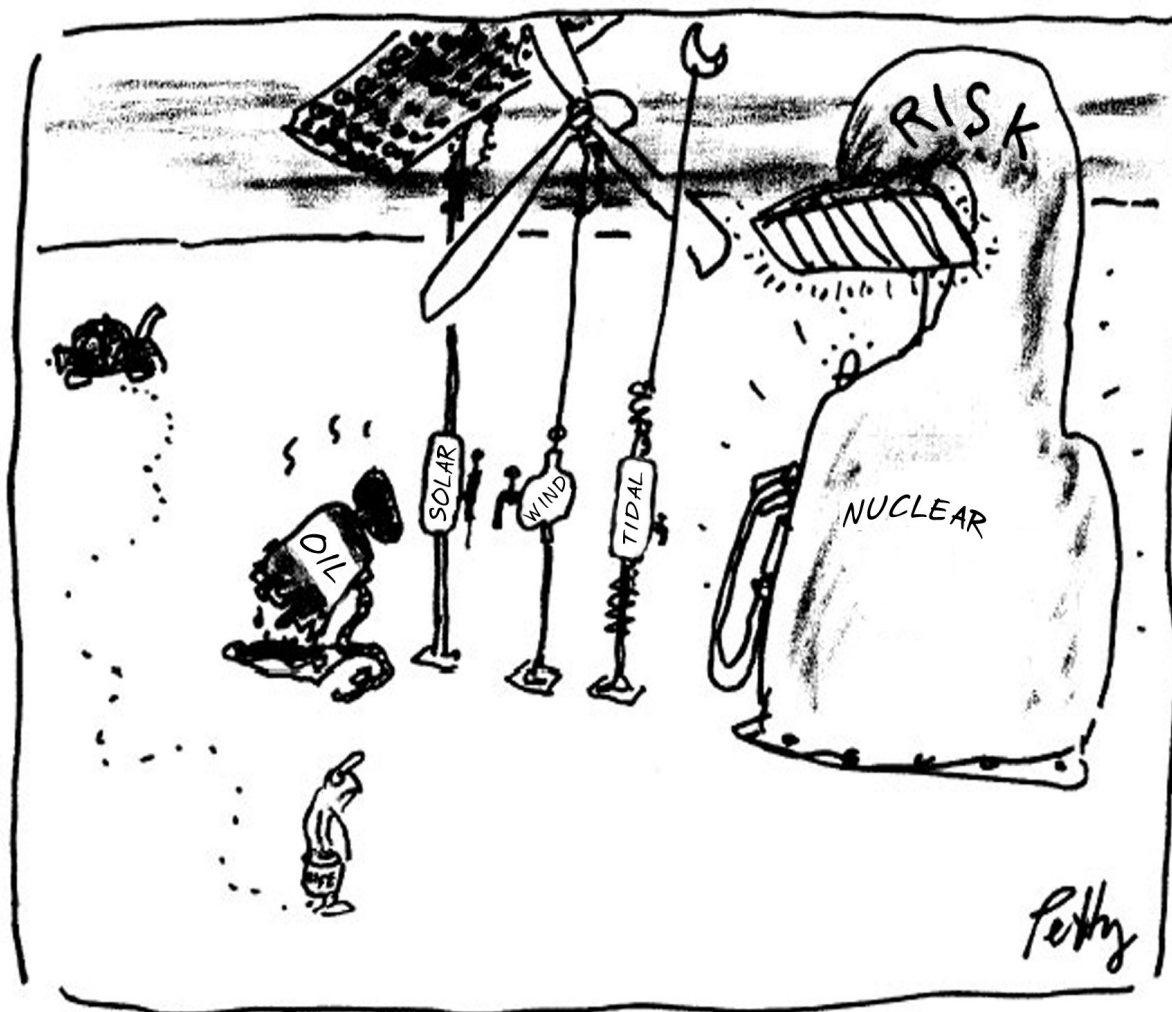
- (b) Outline a method for reducing emissions of greenhouse gases for each human activity in the table below. [3]

Human activity	Method of reducing emissions of greenhouse gases
Generating electricity by burning fossil fuels	<div>.....</div> <div>.....</div> <div>.....</div>
Livestock farming	<div>.....</div> <div>.....</div> <div>.....</div>
Driving a car	<div>.....</div> <div>.....</div> <div>.....</div>



6. Figure 7 below is a cartoon from Australia and shows five sources of energy: oil, solar, wind, tidal and nuclear.

Figure 7



[Source: adapted from www.democrats.org.au/campaigns/nuclear_industry/]

Reprinted with the artist's permission.

- (a) State **two** of the sources of energy shown in Figure 7 that are renewable.

[1]

(This question continues on the following page)



(Question 6 continued)

- (b) Suggest **two** possible messages the artist is trying to communicate with this cartoon. [2]

.....

.....

.....

.....

- (c) Define the term *carrying capacity*. [1]

.....

.....

- (d) The population density of Australia is 2.6 people per km² compared to 230 people per km² for Germany. Suggest why some people say Australia has reached human carrying capacity. [1]

.....

.....



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

Answers written on this page will
not be marked.



2020