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ENVIRONMENTAL SYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 1

Candidate session number

0	0							

Monday 23 May 2011 (morning)

1 hour

Examination code

2	2	1	1	–	6	3	0	1

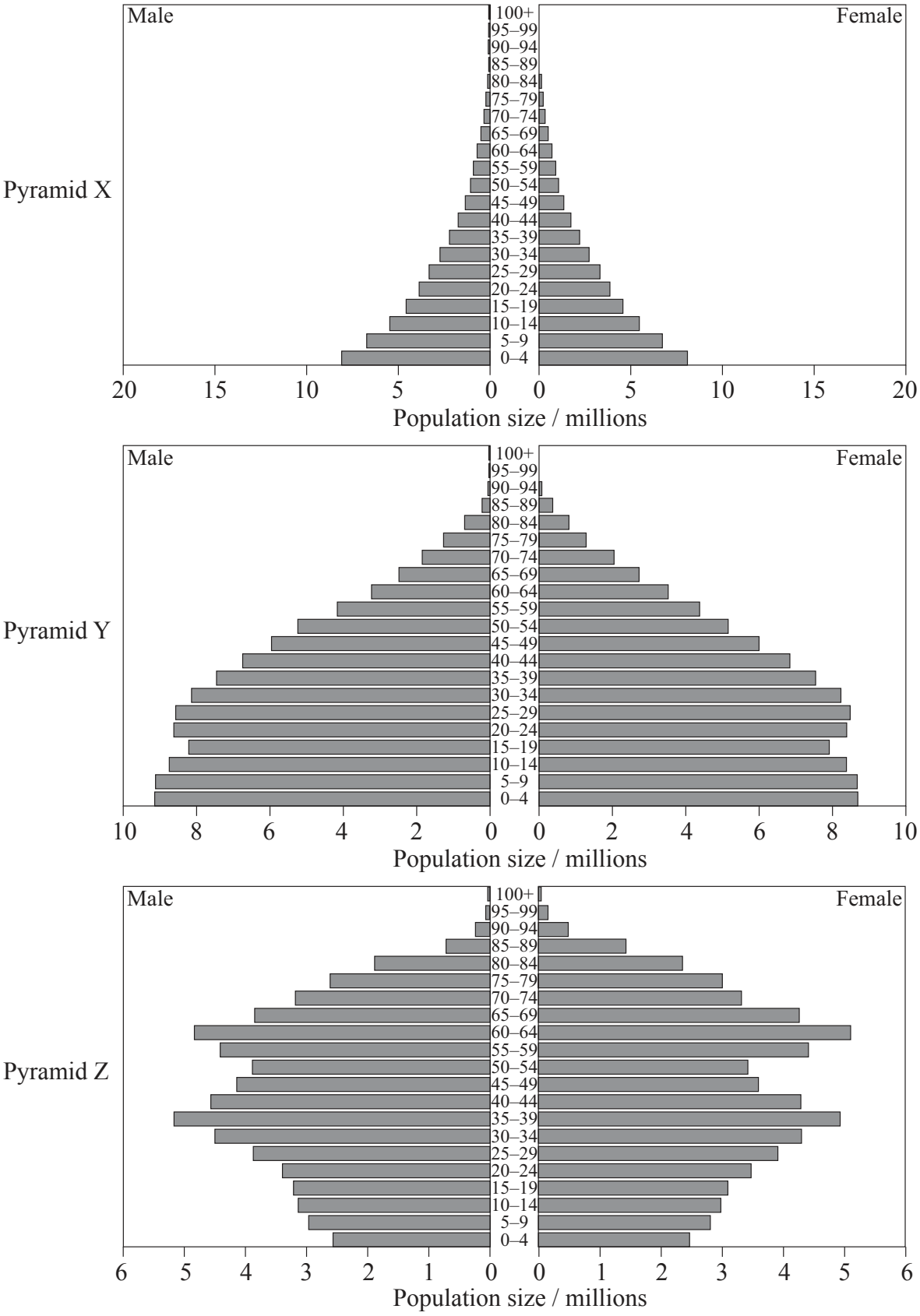
INSTRUCTIONS TO CANDIDATES

- 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: . . . . . .

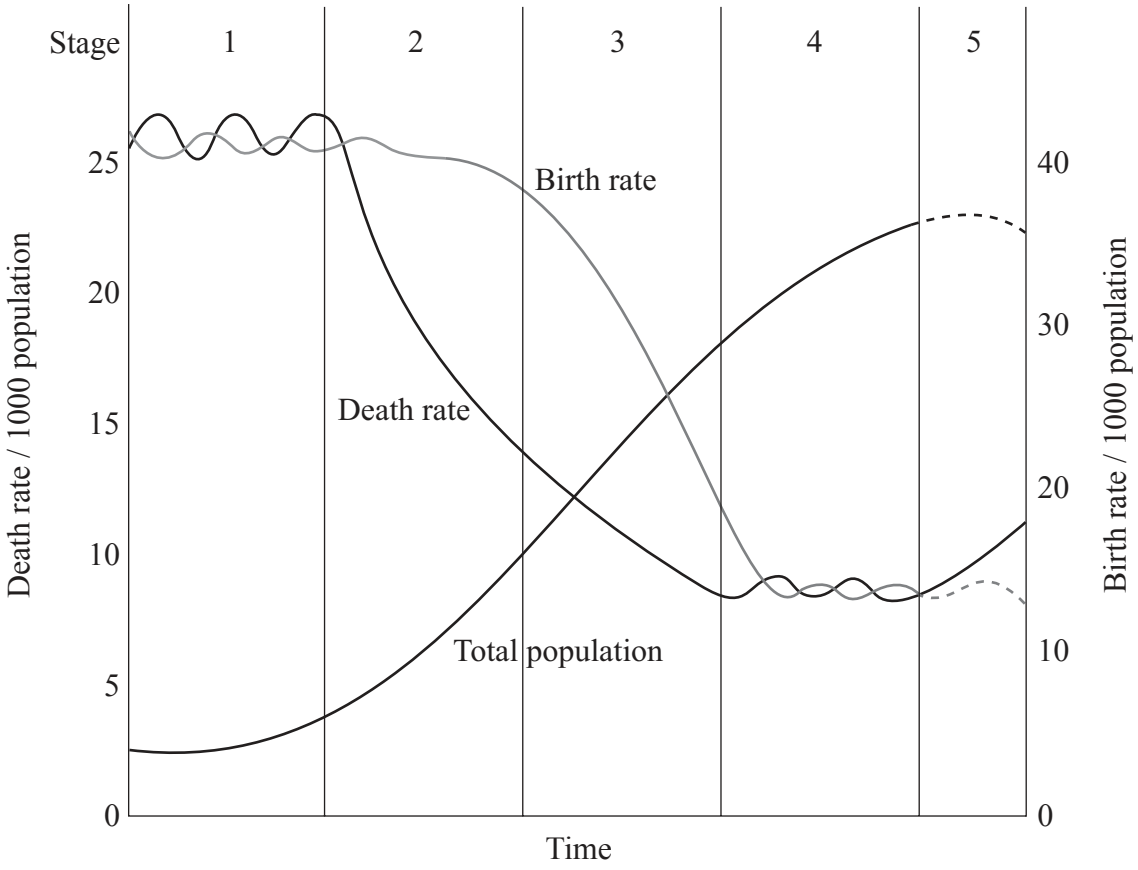
Japan: . . . . . .

(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]

(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]*

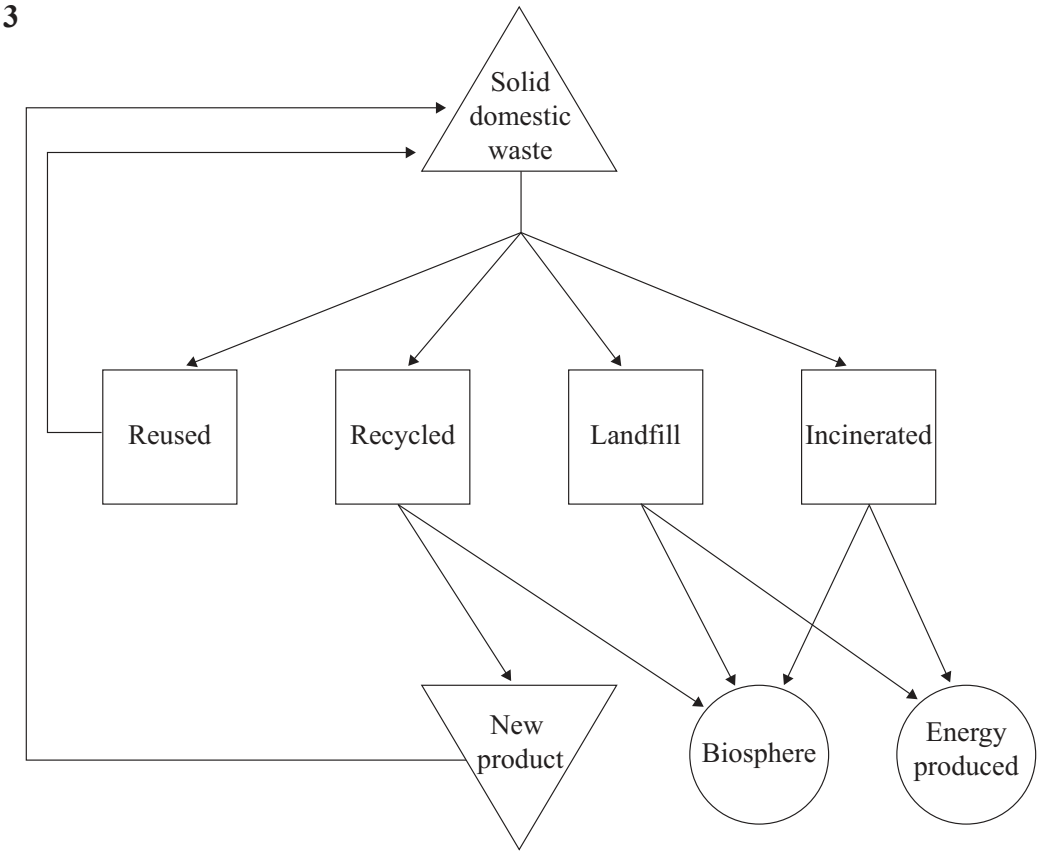
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(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]*

Method of solid waste disposal:

. . . . . .

Material managed in this way:

. . . . . .

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

. . . . . .

. . . . . .

. . . . . .

. . . . . .

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

. . . . . .

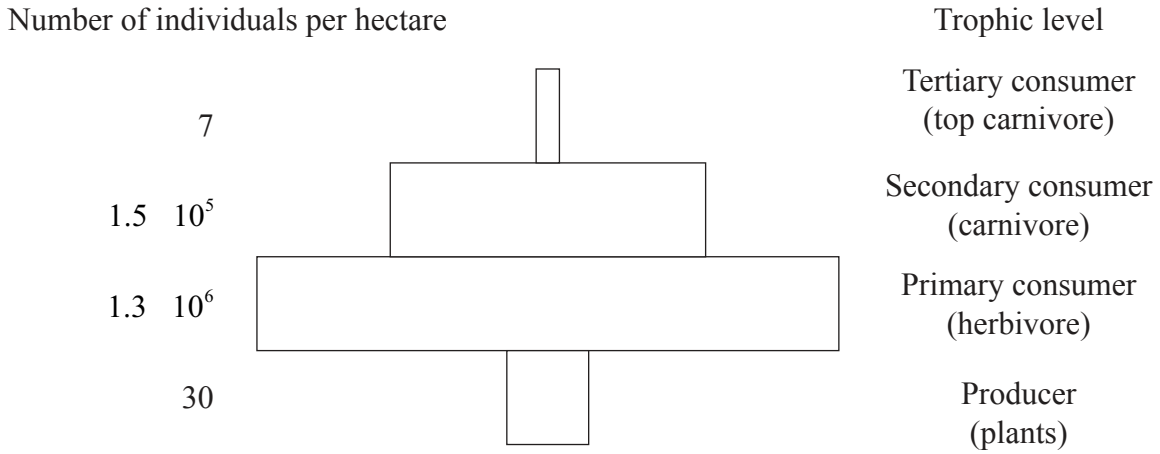
. . . . . .

. . . . . .

. . . . . .

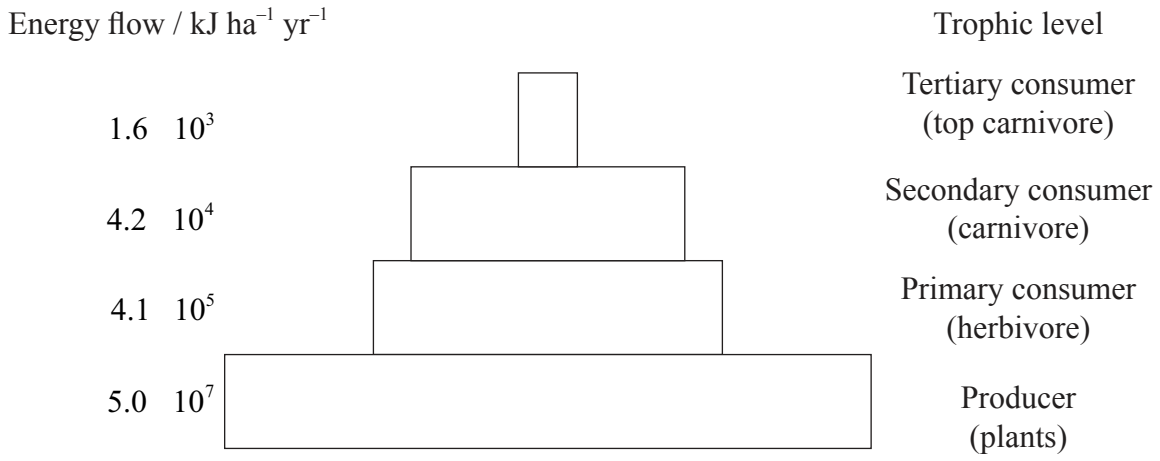
3. Figure 4(a) below shows a pyramid of numbers and Figure 4(b) shows a pyramid of productivity (both in log scale) for a temperate deciduous woodland ecosystem.

Figure 4(a)



J.L. Chapman and M.J. Reiss, Ecology: Principles and Applications, 2nd ed., 1998,

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]*

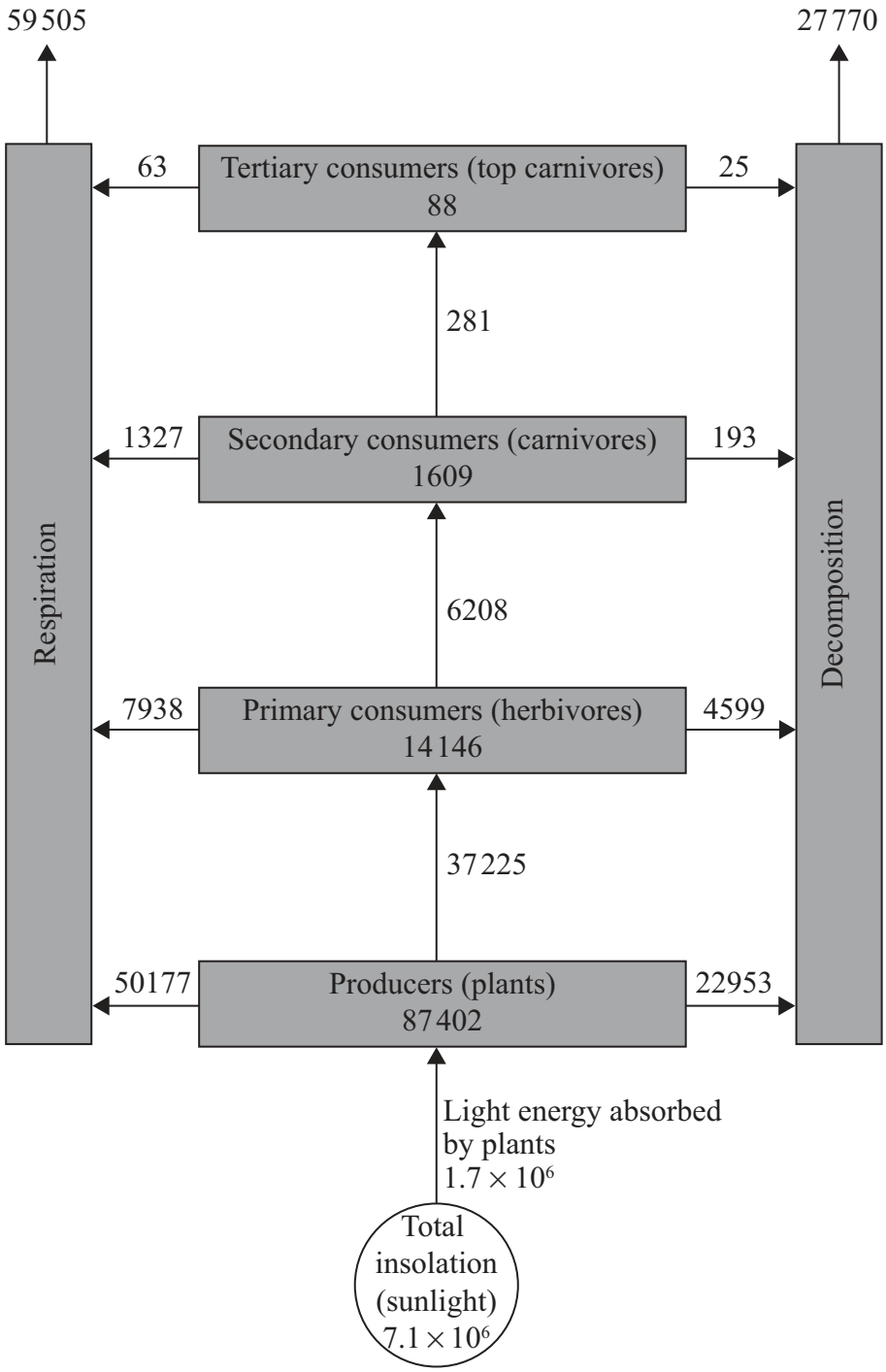
Human activity	How pyramid structure is changed
1.	. . . .
2.	. . . .

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 (kJ m^{-2} 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]*

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

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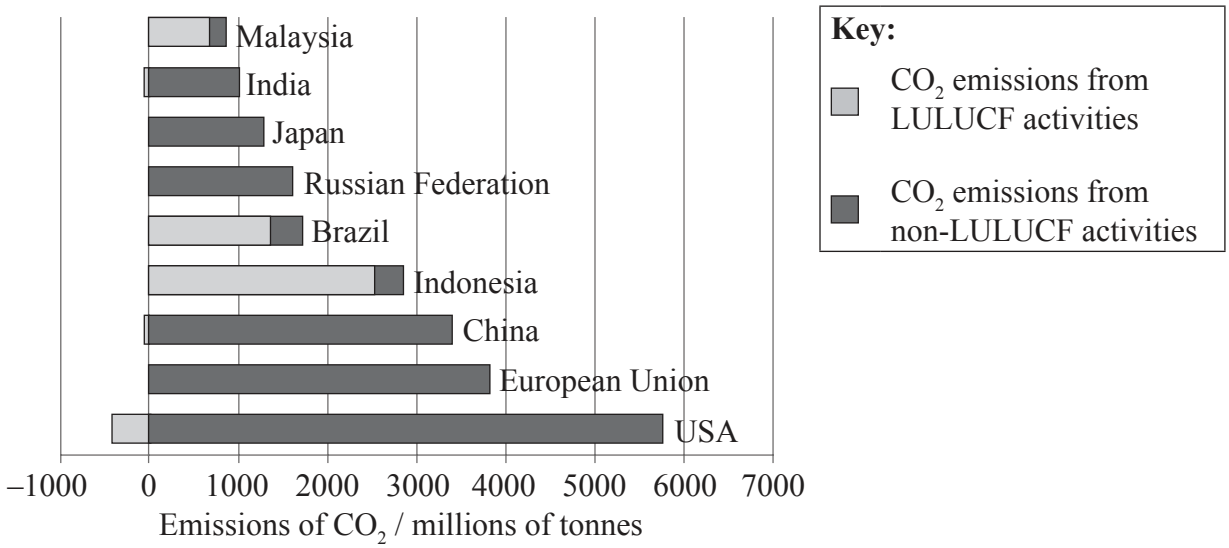
5. Land use, land use change and forestry (LULUCF) and non-LULUCF activities affect the global carbon cycle. These activities add or remove carbon dioxide (CO_2) from the atmosphere.

- 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 CO_2 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** CO_2 emissions and which country has the highest CO_2 emissions from LULUCF. *[1]*

Highest total CO_2 emissions:

. . . . . .

Highest CO_2 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 CO_2 emissions in some countries. *[2]*

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

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

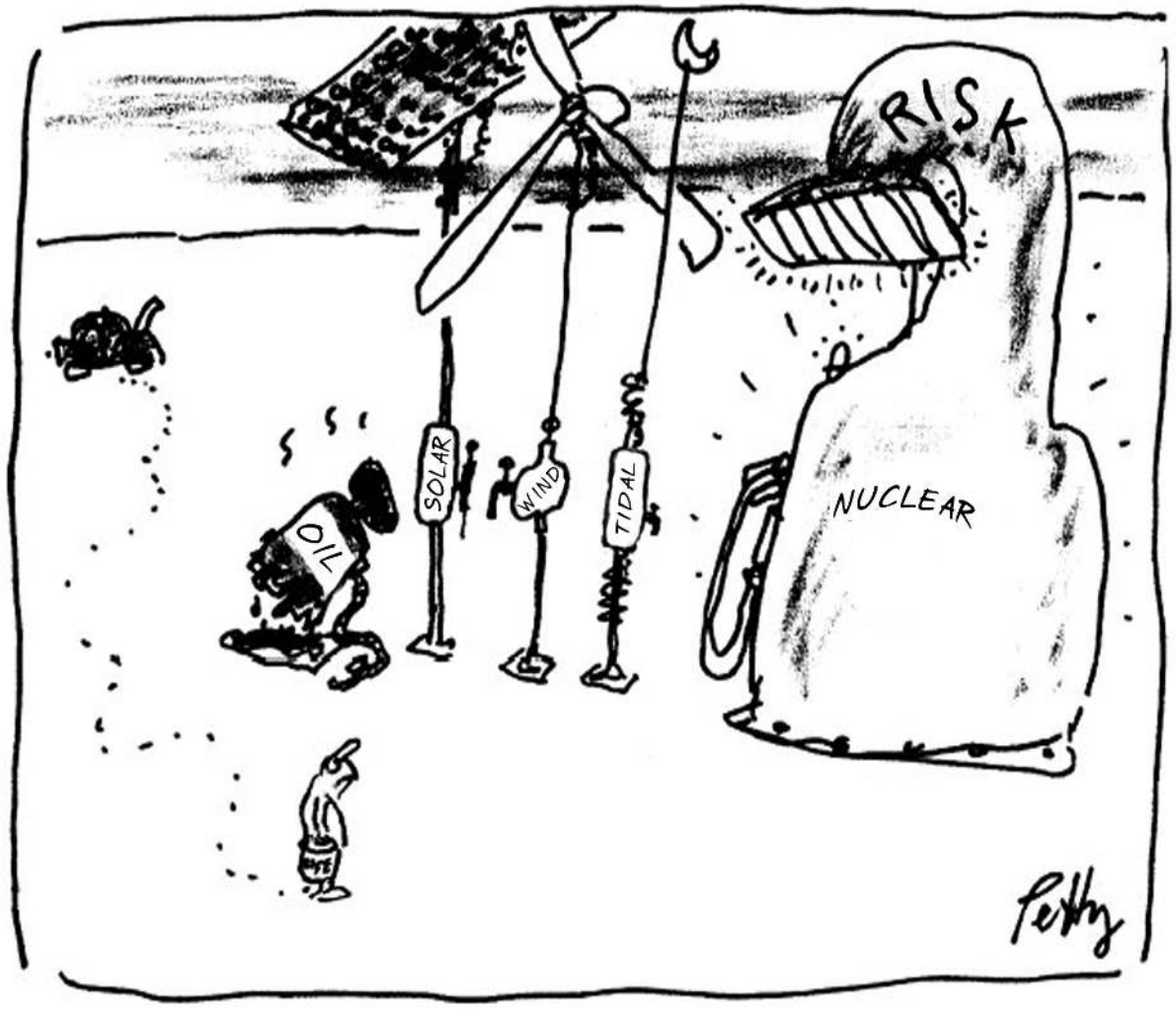
. . . .
. . . .

(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	. . . .
Livestock farming	. . . .
Driving a car	. . . .

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 km^2 compared to 230 people per km^2 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.