

© International Baccalaureate Organization 2022

All rights reserved. No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without the prior written permission from the IB. Additionally, the license tied with this product prohibits use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, whether fee-covered or not, is prohibited and is a criminal offense.

More information on how to request written permission in the form of a license can be obtained from <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organisation du Baccalauréat International 2022

Tous droits réservés. Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite préalable de l'IB. De plus, la licence associée à ce produit interdit toute utilisation de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, moyennant paiement ou non, est interdite et constitue une infraction pénale.

Pour plus d'informations sur la procédure à suivre pour obtenir une autorisation écrite sous la forme d'une licence, rendez-vous à l'adresse <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organización del Bachillerato Internacional, 2022

Todos los derechos reservados. No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin la previa autorización por escrito del IB. Además, la licencia vinculada a este producto prohíbe el uso de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales—, ya sea incluido en tasas o no, está prohibido y constituye un delito.

En este enlace encontrará más información sobre cómo solicitar una autorización por escrito en forma de licencia: <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

**Environmental systems and societies**  
**Standard level**  
**Paper 2**

Friday 6 May 2022 (morning)

Candidate session number

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

2 hours

---

**Instructions to candidates**

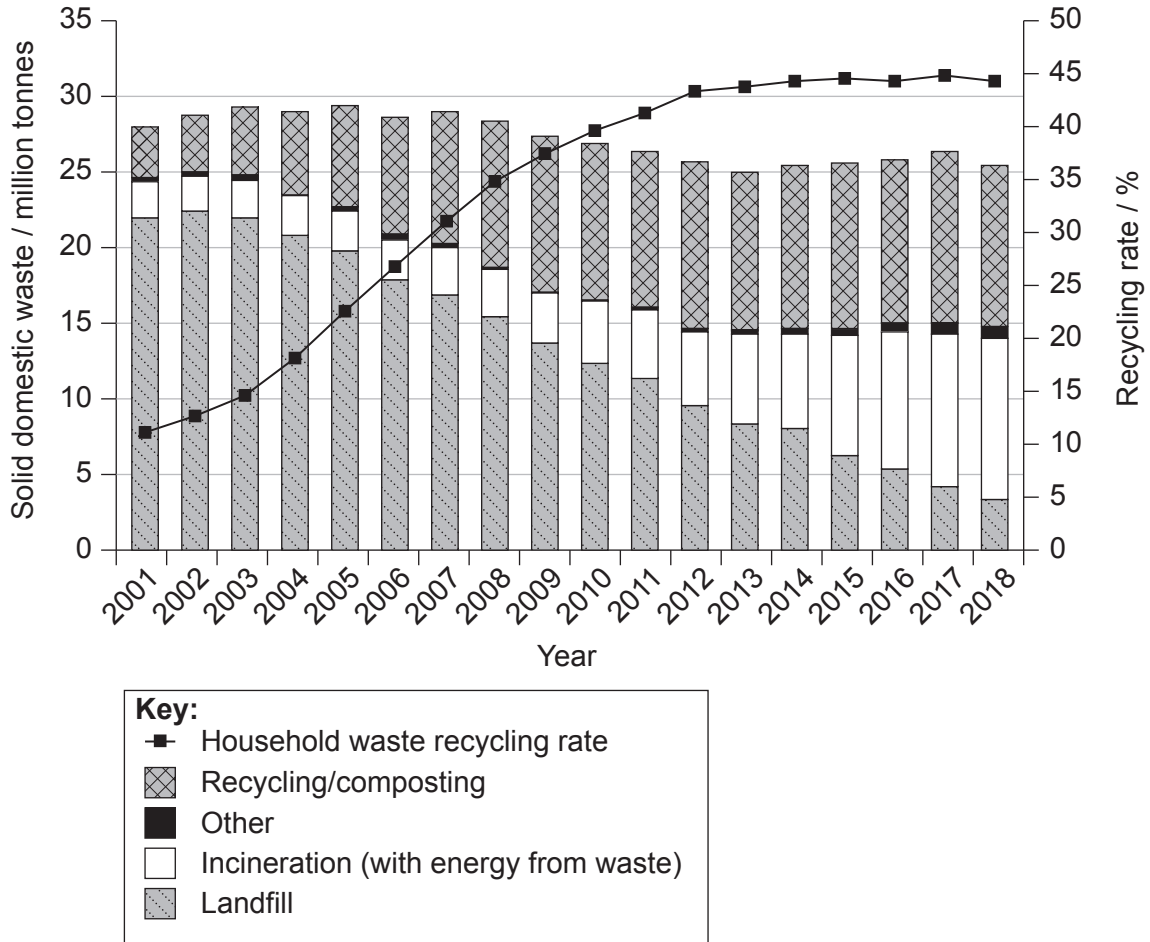
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer two questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[65 marks]**.



### Section A

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

**Figure 1: Management of solid domestic waste in England, 2001–2018**



1. (a) With reference to **Figure 1**, identify the recycling rate in England in 2018. [1]

.....

.....

(b) Outline **one** reason for the shape of the recycling rate curve from 2013 to 2018. [1]

.....

.....

(This question continues on the following page)



**(Question 1 continued)**

- (c) Estimate the reduction in solid domestic waste (in million tonnes) going to landfill from 2001 to 2018.

[1]

.....

.....

- (d) Describe **three** reasons why the proportion of solid domestic waste being recycled/ composted and incinerated has changed.

[3]

.....

.....

.....

.....

.....

.....

- (e) Outline **one** reason why there has been an overall change in recorded total solid domestic waste between 2001 and 2018.

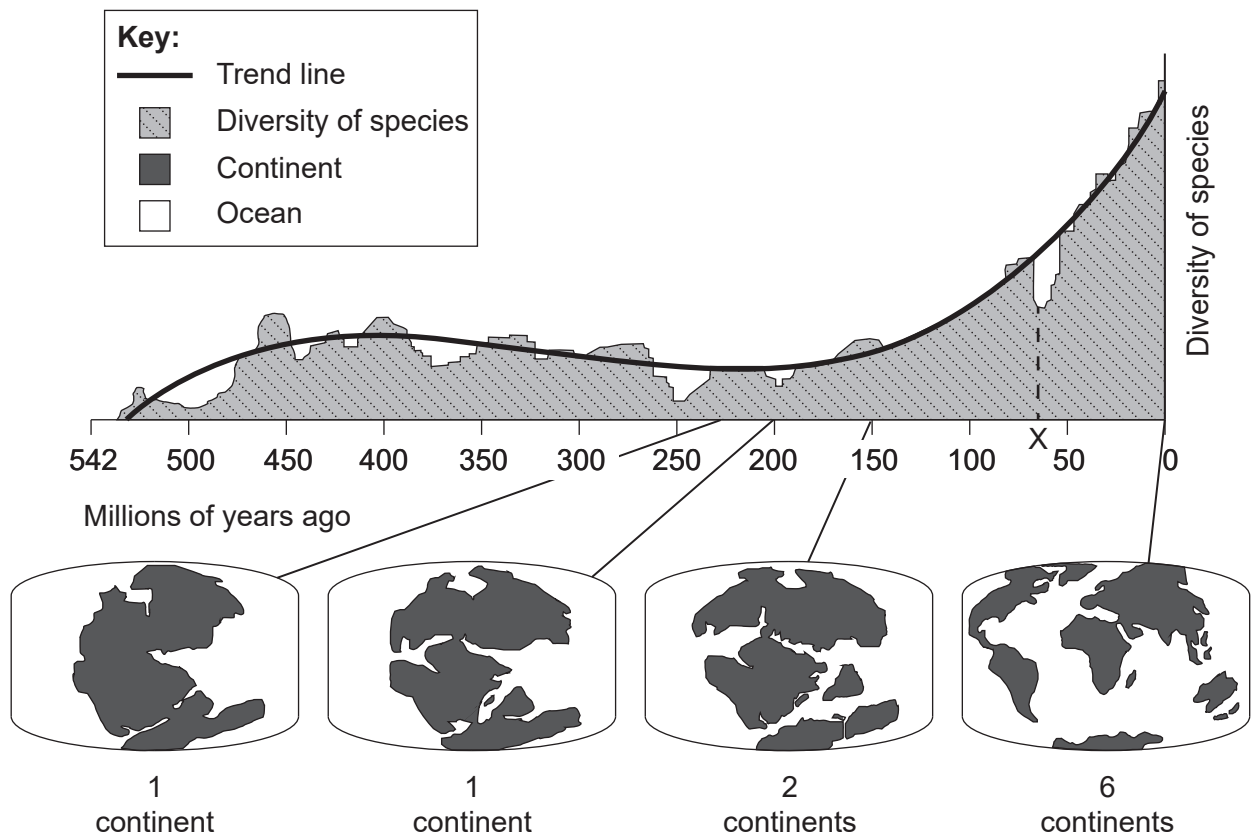
[1]

.....

.....



Figure 2: Distribution of continents and diversity of species over time



2. (a) (i) With reference to **Figure 2**, identify when the diversity of species was lowest in the past 400 million years. [1]

.....

.....

(ii) Describe what may have caused the deviation from the trend line at point X in **Figure 2**. [2]

.....

.....

.....

.....

(This question continues on the following page)



**(Question 2 continued)**

- (b) (i) Identify the relationship between the number of continents and the diversity of species during the past 250 million years. [1]

.....  
.....

- (ii) Describe **two** reasons why there is a relationship between the number of continents and the diversity of species. [2]

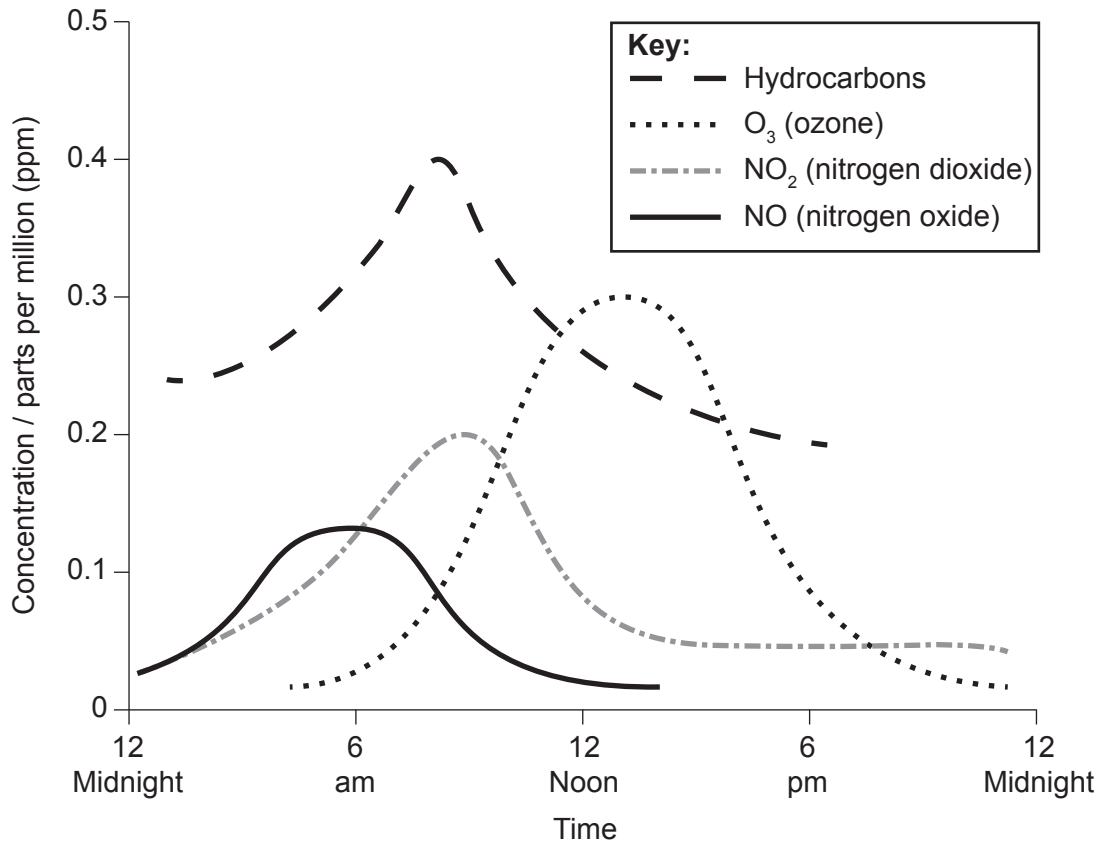
.....  
.....  
.....  
.....

- (c) Outline the role of natural selection in increasing the diversity of species. [2]

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



**Figure 3: Concentration of atmospheric pollutants associated with photochemical smog**



[Source: Reprinted from *Environmental Pollution and Control*, fourth edition, J. Jeffrey Peirce, Ruth F. Weiner and P. Aarne Vesilind, Chapter 18 – Air Pollution, Page 253, Copyright 1998, with permission from Elsevier (<http://www.elsevier.com>).]

3. (a) (i) Identify **one** primary pollutant from the pollutants shown in **Figure 3**. [1]

.....  
.....

(ii) Outline why the pollutant named in Question 3 (a)(i) is referred to as a primary pollutant. [1]

.....  
.....

(b) Outline **one** reason why there is an increase in nitrogen oxides and hydrocarbons early in the day. [1]

.....  
.....

(This question continues on the following page)



**(Question 3 continued)**

(c) Explain the changes in ozone concentration over the period shown in **Figure 3**. [3]

.....

.....

.....

.....

.....

.....

(d) State **one** environmental impact of the accumulation of ozone shown in **Figure 3**. [1]

.....

.....

(e) Outline **two** local conditions that may increase the severity of photochemical smog. [2]

.....

.....

.....

.....

(f) Outline the role of catalytic converters in reducing photochemical smog. [1]

.....

.....





## Section B

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

4. (a) Outline how species diversity and population size influence the resilience of an ecosystem. [4]
- (b) Describe the similarities and differences in using a biotic index and a diversity index to assess ecosystems. [7]
- (c) With reference to named examples, discuss the significance of diversity in the sustainability of food production systems. [9]
5. (a) Outline the role of the atmospheric system in the distribution of biomes. [4]
- (b) Explain how human impacts on the atmosphere may influence the productivity of terrestrial biomes. [7]
- (c) To what extent is the need for conservation more significant in tropical biomes? [9]
6. (a) Outline **four** ways in which urbanization may influence processes in the hydrological cycle. [4]
- (b) Hydropower is a resource that can be exploited from rivers. Explain how the value of this resource to a society may vary over time. [7]
- (c) To what extent are water scarcity issues better addressed through changing human behaviour than through technological development? [9]
7. (a) Outline the processes involved in the formation of fertile soils from bare rock. [4]
- (b) Explain how negative and positive feedback mechanisms may influence the growth of decomposer populations in the soil. [7]
- (c) To what extent are natural limiting factors more likely than population policies to limit global human population growth in the future? [9]



A large rectangular area containing 30 horizontal dotted lines for writing.



24EP09

Turn over

A large rectangular area containing horizontal dotted lines for writing.



24EP10

A large rectangular area containing horizontal dotted lines for writing.



24EP11

Turn over



A large rectangular area containing horizontal dotted lines for writing.



24EP13

Turn over



A large rectangular area containing horizontal dotted lines for writing.



24EP15

Turn over





A large rectangular area containing horizontal dotted lines for writing.



24EP17

Turn over

A large rectangular area containing horizontal dotted lines for writing.



24EP18

A large rectangular area containing horizontal dotted lines for writing.



24EP19

Turn over



A large rectangular area containing horizontal dotted lines for writing.



24EP21

Turn over







## References:

- Figure 1** *Statistics on waste managed by local authorities in England in 2017/18*, Department for Environment, Food and Rural Affairs. Source adapted.
- Figure 2** Biodiversity (in thousands of genera) since the Cambrian explosion of evolution, [https://commons.wikimedia.org/wiki/File:Phanerozoic\\_Biodiversity.svg](https://commons.wikimedia.org/wiki/File:Phanerozoic_Biodiversity.svg). This file is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license. (CC BY-SA 3.0) <https://creativecommons.org/licenses/by-sa/3.0/deed.en>.
- USGS (United States Geological Survey) maps at <https://pubs.usgs.gov/gip/dynamic/historical.html>  
From *This Dynamic Earth: The Story of Plate Tectonics* by W. Jacquelyne Kious and Robert I. Tilling  
Public Domain.
- Figure 3** Reprinted from *Environmental Pollution and Control*, fourth edition, J. Jeffrey Peirce, Ruth F. Weiner and P. Arne Vesilind, Chapter 18 – Air Pollution, Page 253, Copyright 1998, with permission from Elsevier (<http://www.elsevier.com>).

All other texts, graphics and illustrations © International Baccalaureate Organization 2022



24EP24