



Biology
Standard and Higher level
D4.3 Climate change Paper 1A

11 May 2026

Zone A afternoon | **Zone B** morning | **Zone C** afternoon

1 hour [Paper 1A]

Instructions to candidates

- Answer all questions.
- For each question, choose the answer you consider to be the best.
- A calculator is required for this paper.
- This paper generally presents questions in the same order the concepts are presented in the syllabus guide. The earlier questions are usually but not always easier than the later questions. Although most questions focus on this topic only, some are linked to other topics.
- This paper contains challenging IB-style problems. It is meant to enrich your learning and improve your mastery of the concepts presented in this topic after you have studied it.
- All of the questions here are original and written by me.
- **None of the questions are from past papers.**
- The maximum mark for paper 1A is **[40 marks]**.

1. What kind of radiation does the sun emit?
 - A. Microwave radiation
 - B. Infrared radiation
 - C. Long-wave radiation
 - D. Short-wave radiation

2. What happens when the surface of the Earth absorbs sunlight?
 - A. Global warming
 - B. Energy is reemitted
 - C. Plants and animals absorb all radiation
 - D. Energy is stored in volcanoes

3. What is a greenhouse gas?
 - A. A gas molecule that causes climate change
 - B. A gas molecule that absorbs infrared radiation
 - C. A gas molecule that significantly contributes to the greenhouse effect
 - D. A gas molecule that leads to global warming

4. What is the difference between global warming and the enhanced greenhouse effect?
 - A. The enhanced greenhouse effect causes global warming
 - B. Global warming causes the enhanced greenhouse effect
 - C. Only the enhanced greenhouse effect involves greenhouse gases
 - D. Only global warming involves mechanisms that affect Earth's temperature

5. How do greenhouse gases help maintain warm temperatures for living organisms?
 - A. They reemit short-wave radiation in all directions
 - B. They slow down the loss of heat from Earth to space
 - C. They reduce loss of energy between trophic levels due to heat
 - D. They increase their concentrations to help absorb more heat

6. What is a positive feedback mechanism?
- A. A mechanism that drives a biological system towards a positive direction
 - B. A mechanism that drives a biological system towards a positive correlation
 - C. A mechanism that drives variables towards less of the initial signal
 - D. A mechanism that drives variables towards more of the initial signal
7. What is the role of positive feedback cycles in climate change?
- A. They cause more climate change which worsens global warming
 - B. They cause more global warming which worsens climate change
 - C. They cause more positive correlations between anthropogenic factors
 - D. They cause more positive correlations between climate change and radiation
8. What is the difference between global warming and climate change?
- A. Climate change focuses on temperature levels only
 - B. Climate change focuses on weather patterns only
 - C. Global warming focuses on temperature levels only
 - D. Global warming focuses on weather patterns only
9. Why is climate more predictable than day-to-day weather?
- A. Climate is driven by amount of radiation from the sun
 - B. Weather is driven by amount of radiation from the sun
 - C. Climate is an average of weather patterns
 - D. Weather is an average of climate patterns
10. What property of carbon dioxide enables a positive feedback cycle between global warming and deep oceans?
- A. More water soluble at higher temperatures
 - B. Less water soluble at higher temperatures
 - C. More use in photosynthesis at higher temperatures
 - D. Less use in photosynthesis at higher temperatures

- 11.** Which of the following positive feedback cycles in global warming depend on accelerating the release of stored carbon?
- I. Melting of ice and snow
 - II. Melting of permafrost
 - III. Loss of peat
- A. I only
 - B. II only
 - C. II and III only
 - D. I and III only
- 12.** What is a consequence of fires and droughts due to global warming?
- A. Heat from wildfires traps more solar radiation and leads to further warming
 - B. Drought increases the amount of desert biomes
 - C. Fires and droughts cause each other in a positive feedback cycle
 - D. Further global warming due to a positive feedback cycle
- 13.** What is a consequence of melting permafrost?
- A. Release of carbon dioxide only
 - B. Release of methane only
 - C. Release of carbon dioxide and methane only
 - D. Release of methane and water vapour only
- 14.** What is legacy carbon?
- A. Carbon emitted during the Industrial revolution that remained for years
 - B. Carbon that has remained in buried dead matter for many years
 - C. Carbon that remains in living organisms with long ages for many years
 - D. Carbon that frequently undergoes fluxing in the carbon cycle

15. What is a consequence of forest browning in taiga biomes?

- I. Reduction in the complexity of food webs
 - II. Reduction in the availability of water
 - III. Increases in the risk of droughts and wildfires
- A. I only
 - B. I and II only
 - C. II and III only
 - D. I, II and III

16. What is a consequence of global warming on polar habitats?

- A. Selection pressures become more intense on polar animals
- B. Loss of ice increases water availability for polar animals
- C. Offspring of polar animals have access to more habitat
- D. Breeding and hunting improve as ice coverage decreases

17. The image shows Emperor penguins (*Aptenodytes forsteri*).



How is this species affected by climate change?

- A. Loss of landfast ice affects their breeding success
- B. Loss of sea ice affects their breeding success
- C. Loss of glaciers affects their breeding success
- D. Loss of Arctic land affects their breeding success

18. The image shows Arctic walrus (*Odobenus rosmarus*).



How is this species affected by climate change?

- A. The amount of seashore ice used by adult walrus for resting decreases
 - B. The species struggles to survive due to drowning from melting ice
 - C. The amount of ice in the sea used by adult walrus for resting decreases
 - D. The species migrates northwards to cope with the warming temperatures
19. Which of the following can alter the timing and extent of nutrient upwelling?
- I. The rate of temperature change from surface to deep water
 - II. The density of water
 - III. The depth of the ocean
- A. I only
 - B. I and II only
 - C. II and III only
 - D. I, II and III
20. What is the cause of poleward range shifts of North American trees?
- A. More successful seed germination in northern than southern land
 - B. More successful seed germination in southern than northern land
 - C. Migration of trees to the north pole in order to experience cooler climate
 - D. Migration of trees to the southern pole in order to experience cooler climate

21. Which chemical equation will have higher yields due to climate change?

- A. $\text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^- + \text{H}^+$
- B. $\text{HCO}_3^- \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- C. $\text{CO}_2 + \text{HCO}_3^- \rightarrow \text{H}_2\text{O} + 2\text{CO}_3^{2-}$
- D. $\text{HCO}_3^- + \text{H}^+ \rightarrow \text{H}_2\text{CO}_3$

22. Which option **correctly** matches the effects of ocean acidification and warming?

	Ocean acidification	Ocean warming
A.	Coral bleaching	Coral bleaching
B.	Coral bleaching	Suppression of calcification
C.	Suppression of calcification	Coral bleaching
D.	Suppression of calcification	Suppression of calcification

23. What is the consequence of rising atmospheric carbon dioxide levels on oceans?

- A. It causes oceans to gradually become acidic
- B. It causes oceans to gradually become more acidic
- C. It causes lower production of hydrogen ions
- D. It causes higher production of carbonate ions

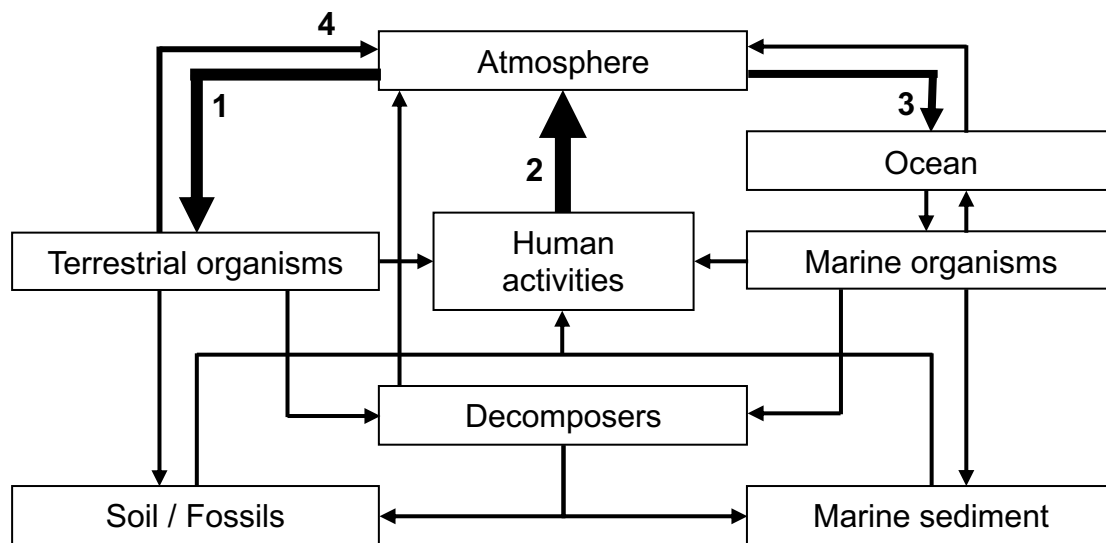
24. Which chemical species is directly used in calcification?

- A. H_2CO_3
- B. HCO_3^-
- C. CO_3^{2-}
- D. CO_2

25. Why is the disruption of symbiosis between corals and algae harmful?

- A. Algae live in coral tissue
- B. Algae give corals their color
- C. Algae are the primary source of food for corals
- D. Algae expulsion leads to loss of color in corals

26. The arrows in this diagram of the carbon cycle vary according to the magnitude of carbon fluxing. Which flux does carbon sequestration aim to change in magnitude?



- A. Flux 1
- B. Flux 2
- C. Flux 3
- D. Flux 4
27. Carbon sequestration can be done by plantations of either native or non-native tree species. Which approach is considered best by the scientific community?
- A. This is an active area of scientific debate
- B. Using native trees is best because it restores ecosystem biodiversity
- C. Using non-native trees is best because it is cost effective
- D. Scientists debate other methods to carbon sequestration
28. How can afforestation be used to combat climate change?
- A. It plants more trees in forests to absorb more carbon by photosynthesis
- B. It introduces primary producers in empty land to store more carbon in biomass
- C. It strengthens vegetation to carry out further forest expansion
- D. It increases carbon fixation rates by removing forests to trap less heat

29. How can peat wetlands be restored?

- I. Introducing species that are native to peat wetlands
 - II. Improving drainage to preserve waterlogged conditions
 - III. Restoring the levels of water in the ecosystem
- A. I only
 - B. II only
 - C. II and III only
 - D. I and III only

30. [AHL] What is phenology?

- A. The study of environmental cues that affecting biological events
- B. The study of how biological events change with time
- C. The study of biological events changing in specific periods of time
- D. The study of the timing of biological events

31. [AHL] What is the correct about budburst?

- A. Budburst is timed to when weather becomes warmer
- B. Budburst is timed to when weather becomes colder
- C. Budburst is timed to when flowers bloom in the spring
- D. Budburst is timed to when leaves fall before winter

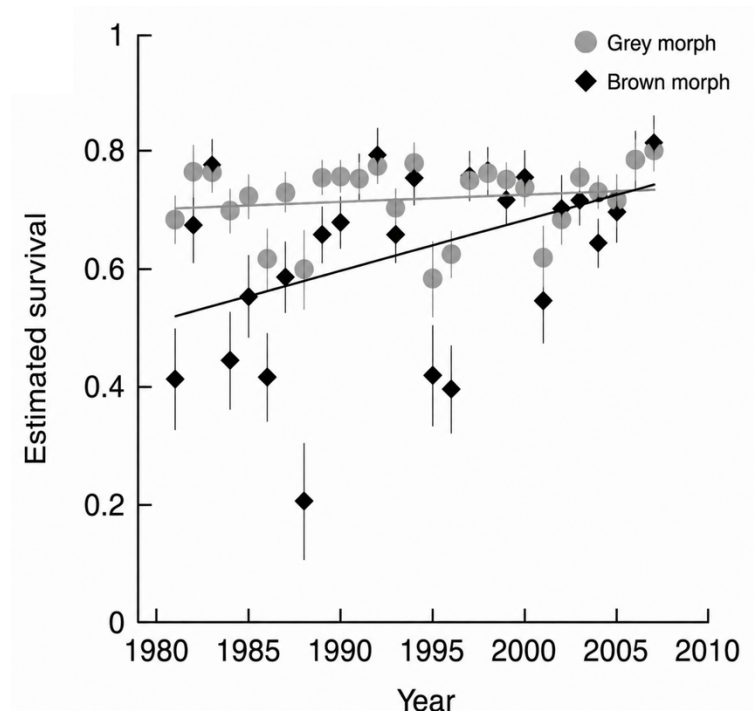
32. [AHL] How does climate change disrupt phenological synchrony?

- A. It changes the synchrony of environmental cues
- B. It changes the value of environmental cues in organisms
- C. It changes the synchrony of environmental conditions
- D. It changes the values of environmental conditions

- 33. [AHL]** What will most likely lead to disruption of phenological synchrony?
- A. Two interacting species have the same environmental cues
 - B. Two interacting species have different environmental cues that are changing at different rates
 - C. Two interacting species have different environmental cues that are changing at similar rates
 - D. Two interacting species have different environmental cues that depend on the length of time they are exposed to sunlight
- 34. [AHL]** Does climate change affect photoperiod?
- A. Yes because it changes the intensity of solar radiation
 - B. Yes because it changes the levels of greenhouse gases during the day
 - C. No because it does not depend on climatic variables
 - D. No because it does not depend on weather patterns
- 35. [AHL]** Which environmental cue does Arctic mouse-ear chickweed depend on?
- A. Temperature
 - B. Photoperiod
 - C. Rainfall
 - D. Budburst
- 36. [AHL]** What is a consequence of global warming on great tit birds?
- A. Great tits breed before caterpillars become abundant
 - B. Caterpillar abundance decreases because birds breed progressively later
 - C. Caterpillar biomass peaks before chicks require most food
 - D. Great tit biomass decreases before caterpillars are able to grow

37. **[AHL]** What is a consequence of faster spruce bark beetle life cycles?
- A. Higher decomposition rates
 - B. Greater tree mortality
 - C. Reduced beetle age
 - D. Lower beetle reproductive success
38. **[AHL]** What must be true if tawny owls experience evolution due to climate change?
- A. Their plumage color is solely determined by genetic factors
 - B. Their plumage color is mostly determined by genetic factors
 - C. Their plumage color is determined equally by genetic and epigenetic factors
 - D. Their plumage color is solely determined by epigenetic factors
39. **[AHL]** How is climate change altering the fitness of colour variants of the tawny owl?
- A. Brown plumage is becoming more favorable
 - B. Grey plumage is becoming less favorable
 - C. The strength of selection against grey plumage is weakened
 - D. The strength of selection against brown plumage is weakened

40. **[AHL]** The graph shows the estimated survival of grey and brown variants (morphs) of the tawny owl between 1980 and 2010.



What can be correctly concluded from this data?

- A. Declining snow depth favors brown owls over grey owls
- B. Brown owls are becoming more represented within the population
- C. The standard deviation of brown morph data is too high to make a conclusion
- D. Survival of grey owls is decreasing as selection for them is weakening

References:

- 17. Rafferty, John P.. "emperor penguin". Encyclopedia Britannica, 24 Jul. 2026, <https://www.britannica.com/animal/emperor-penguin>.
- 18. Carino, Liz. "Top 10 Fun Facts About Walrus." Arctic Kingdom, <https://resources.arctickingdom.com/10-fun-facts-about-walrus>
- 40. Karell, P., Ahola, K., Karstinen, T. et al. Climate change drives microevolution in a wild bird. Nat Commun 2, 208 (2011). <https://doi.org/10.1038/ncomms1213>