



Biology

Standard and Higher level

A1.1 Water Paper 1A

18 August 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 is the medium for life?
 - A. Air
 - B. Water
 - C. Cytosol
 - D. Cytoplasm

2. Which medium did the first cells originate in?
 - A. Hydrothermal vents
 - B. Volcanic rock
 - C. Water
 - D. Tropical forests

3. Which of the following is a function of water in living organisms?
 - I. Solvent for chemical reactions
 - II. Reactant in chemical reactions
 - III. Product in chemical reactions
 - A. I only
 - B. II only
 - C. I and II only
 - D. I, II and III

4. Which of the following apply to covalent bonding?
 - I. Equal sharing of electrons
 - II. Unequal sharing of electrons
 - III. Equal loss and gain of electrons
 - A. I only
 - B. II only
 - C. I and II only
 - D. I and III only

5. How does polar covalent bonding occur?
- A. Polarity is a property of covalent bonds between specific atoms
 - B. Electrons move between two atoms in an unequal manner
 - C. One atom loses an electron more strongly to the other atom
 - D. One atom pulls electrons more strongly than the other
6. What is the charge of an atom that exists in a non-polar covalent bond?
- A. δ
 - B. $\delta+$
 - C. $\delta-$
 - D. 0
7. Why are intermolecular forces important if they are weaker than covalent bonding?
- A. They are non-negligible in large numbers
 - B. They are negligible in large numbers
 - C. They are non-negligible in small numbers
 - D. They are negligible in small numbers
8. What is hydrogen bonding?
- A. Polar attractions between carbon and hydrogen
 - B. Polar attractions between oxygen and hydrogen
 - C. Polar attractions between oxygen and nitrogen
 - D. Polar attractions between phosphorus and hydrogen
9. How does the structure of water molecules enable hydrogen bonding?
- A. Covalent bonds form between hydrogen and oxygen in different molecules
 - B. Hydrogen bonding forms within a water molecule due to polar covalent bonds
 - C. Partially charged oxygen and hydrogen atoms in water attract oppositely charged hydrogen and oxygen atoms in other molecules
 - D. The small size of water molecules enables them to pack closely together

- 10.** Which of the following elements can form hydrogen bonds?
- I. Nitrogen
 - II. Phosphorus
 - III. Oxygen
- A. I only
 - B. II only
 - C. I and II only
 - D. I and III only
- 11.** What is cohesion of water molecules?
- A. Attraction of different molecules by hydrogen bonding
 - B. Attraction of the same molecules by hydrogen bonding
 - C. Attraction of different molecules by polar interactions
 - D. Attraction of the same molecules by polar interactions
- 12.** What is a consequence of water cohesion?
- A. High specific heat capacity
 - B. High melting and boiling points
 - C. Surface tension
 - D. Hydrogen bonding
- 13.** What is surface tension?
- A. Attraction of water to surrounding surfaces due to cohesion
 - B. Attraction of water to surrounding surfaces due to adhesion
 - C. Resistance of a water surface to deformation due to adhesion
 - D. Resistance of a water surface to deformation due to cohesion

14. What is a consequence of the high surface tension of water?
- A. The surface of water is easy to penetrate by fish
 - B. Water surface serves as a habitat for some organisms
 - C. Aquatic birds can easily spot fish in the water
 - D. Marine plants can easily absorb water from the surface
15. What is **correct** about the transpiration stream?
- A. It is continuous due to cohesion
 - B. It is continuous due to adhesion
 - C. It is discontinuous due to cohesion
 - D. It is discontinuous due to adhesion
16. What is capillary action?
- A. The ability of a fluid to flow through narrow spaces against gravity
 - B. The ability of a fluid to flow through narrow spaces with gravity
 - C. The ability of a fluid to flow through wide spaces against gravity
 - D. The ability of a fluid to flow through wide spaces with gravity
17. What accounts for the adhesion of water molecules?
- A. Hydrogen bonding
 - B. Covalent bonding
 - C. Non-covalent bonding
 - D. Hydrophobic interactions
18. What is the role of water adhesion in xylem vessels?
- A. Creates tension that draws up water
 - B. Complements surface tension to create negative pressure
 - C. Prevents tension from breaking the continuity of the transpiration stream
 - D. Prevents the water column from pulling away from the xylem walls

- 19.** What is the role of capillary action in soil?
- A. Allows water to travel through soil by the cohesion from roots to stem
 - B. Allows water to flow into root cells due to a concentration gradient
 - C. Allows water to drain through large soil pores by adhesion
 - D. Allows water in soil to travel by adhesion up to plant roots
- 20.** What is the role of water in metabolism?
- A. It acts as a source of energy due to high specific heat capacity
 - B. It prevents hydrophobic molecules from interacting with metabolism
 - C. It serves a solvent for reactants and products
 - D. It helps organisms carry out reactions due to its properties
- 21.** What does the function of molecules depend on?
- I. Their size
 - II. Their insolubility in water
 - III. The elements in their chemical structure
- A. I only
 - B. II only
 - C. I and II only
 - D. I, II and III
- 22.** Why is it advantageous for some molecules to be hydrophobic?
- A. It increases their chances of attracting each other
 - B. It enables them to regulate osmolarity by reducing interactions of water
 - C. It allows them to associate away from water to form barriers
 - D. It prevents them from forming hydration shells

- 23.** What is buoyancy?
- A. The resistance of a fluid to movement of an immersed object
 - B. The upward force exerted by a fluid on an immersed object
 - C. The tendency of an object to rise because its mass decreases in water
 - D. The upward movement of water caused by displacement of an object
- 24.** How is buoyancy in water and air different?
- A. Weight is offset by buoyancy in air
 - B. Weight is offset by viscosity in air
 - C. Weight is offset by buoyancy in water
 - D. Weight is offset by viscosity in water
- 25.** What is a consequence of water buoyancy on aquatic organisms?
- A. Less structural support is required to maintain body shape
 - B. Less energy is required to overcome water resistance during movement
 - C. Greater skeletal support is required to allow floating
 - D. Greater muscle mass is required to counteract the upward force of water
- 26.** What is viscosity?
- A. The resistance of a fluid surface to deformation
 - B. The resistance of a fluid to changes in temperature
 - C. The resistance of a fluid to upward forces
 - D. The resistance of a fluid to flow
- 27.** How does hydrogen bonding affect viscosity of water?
- A. It increases viscosity by creating strong intermolecular forces between water
 - B. It increases viscosity by holding water molecules together
 - C. It decreases viscosity by unequal sharing of electrons which reduces mass
 - D. It decreases viscosity enabling water molecules to adhere to other molecules

- 28.** What is a consequence of water viscosity on aquatic organisms?
- A. It reduces the need for skeletal support as it provides upward force support
 - B. It selects for more streamlined body shapes
 - C. It resists displacement of the water surface to keep organisms afloat
 - D. It prevents sinking of organisms by increasing friction within water molecules
- 29.** What is specific heat capacity?
- A. The energy required to raise the temperature of a unit volume by one degree
 - B. The energy required to raise the temperature of a unit mass by one degree
 - C. The energy required to reach a rate of temperature change per unit mass
 - D. The energy required to reach a rate of temperature change per unit volume
- 30.** What is thermal conductivity?
- A. The ability of a substance to conduct thermal energy quickly
 - B. The ability of a substance to conduct thermal energy at a specific temperature
 - C. The ability of a substance to conduct thermal energy through its particles
 - D. The ability of a substance to conduct thermal energy at a specific rate
- 31.** Which substance will experience the fastest rate of temperature gain if exposed to a source of heat?
- A. Pure water
 - B. Water with dilute solutes
 - C. Water with concentrated solutes
 - D. Air

32. The image shows the black-throated loon (*Gavia arctica*). What is the role of hydrophobic molecules in overcoming harmful consequences of water's high specific heat capacity on the black-throated loon?



- A. Thick blubber in its body reduces heat loss to water by convection
 - B. Thick blubber in its body reduces heat loss to water by conduction
 - C. Oil glands reduce heat loss to water by convection
 - D. Oil glands reduce heat loss to water by conduction
33. The image shows the ringed seal (*Pusa hispida*). How is this species adapted to the challenges of water viscosity?



- A. The shape of its body reduces drag when it swims
- B. The thick blubber layer reduces resistance between water molecules
- C. The flattened flippers improve its buoyancy and its ability to stay afloat
- D. The hydrophobic oily fur reduces tension around the body

- 34.** Which physical property of water allows ice to float on top of liquid water?
- A. Buoyancy
 - B. Viscosity
 - C. Specific heat capacity
 - D. Thermal conductivity
- 35.** A water pollutant in a pond reduces hydrogen bonding between water molecules. Which organism would be most affected?
- A. A fish relying on hydrogen bonding dissolving nutrients
 - B. Green algae that grow in population size due to eutrophication
 - C. A bacterium relying on water as a solvent for metabolic reactions
 - D. Water strider that walks on the surface of water
- 36.** A freshwater lake experiences a sudden drop in air temperatures overnight, but the water temperature decreases only slightly. Which property of water explains this?
- A. Viscosity
 - B. Buoyancy
 - C. Thermal conductivity
 - D. High specific heat capacity
- 37. [AHL]** What is Goldilocks zone?
- A. A region around a planet that enables liquid water to exist on its surface
 - B. A region around a star that enables liquid water to exist on its surface
 - C. A region within a planet that enables liquid water to exist on its surface
 - D. A region within a star that enables liquid water to exist on its surface

- 38. [AHL]** What is the asteroid theory?
- A. A theory that posits that asteroids are the reason for the dinosaur extinction
 - B. A theory that posits that Earth lost water due to collisions of asteroids
 - C. A theory that posits that asteroids delivered water to Earth
 - D. A theory that posits that asteroids cause frequent extinctions on Earth
- 39. [AHL]** What property of Earth is a reason for the retention of water?
- A. High oxygen concentrations
 - B. Greenhouse gases that trap heat
 - C. Strong gravitational pull
 - D. Orbit of the moon around Earth
- 40. [AHL]** Why is the search for extraterrestrial life linked to the presence of water?
- A. Hydrogen bonding in water is the foundation of many habitats
 - B. Cohesion and adhesion are important for the physiology of living organisms
 - C. Chemical reactions cannot occur in solvents other than water
 - D. Water is the medium for life
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References:

- 32. **Image:** © Lars Petersson - My World of Bird Photography.
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