2. Biological Molecules

2.4 Water

Paper 2

Marking Scheme

Q1.

(b)	*any **two** from:* **1** water is, a polar molecule / polar / dipolar ; **A** water is a dipole **A** description e.g. the O atom (of water) has, a slightly negative / δ^-, charge, and the H atoms have a slightly positive / δ^+, charge **2** water can form, hydrogen bonds / H-bonds, with, glycerol / polar substances ; **ora** = water cannot form H-bonds with, triglycerides / non-polar substances **3** glycerol / polar molecules / ions, interact with water (molecules) / are attracted to water (molecules) / are hydrophilic ; **A** idea that water, attracts / collects around / AW, ions / charged substances **ora** = triglycerides / non-polar / uncharged, molecules, do not interact with water / repel water / are hydrophobic **I** 'tails'	**2**

Q2.

(b)	*any **three** from:* (because) water is, polar / a polar molecule / polar / dipolar ; **A** delta positive hydrogen atom / $H^{\delta+}$, **and,** delta negative oxygen atom / $O^{\delta-}$ *ref. to* attraction between, (negatively charged) chloride ions / Cl^-, and $H^{\delta+}$; *ref. to* attraction between, (positively charged) sodium ions / Na^+ and $O^{\delta-}$; *if both ideas (mp2 and mp3) stated, then this is also mp1* water molecules collect around sodium chloride (and separate ions) ; AVP ; e.g. ionic bond broken (between sodium and chloride atom) *ref. to* hydration shell(s) *idea that* ions are separated (and spread through the water) *If no marks gained allow one mark for idea of attraction between water and, ions / NaCl*	**3**

Q3.

(b)	*any **three** from:* *max 1 mark (from mp1 / mp2) if response completely based on water movement within the plant* *mps 1-4: ref. to water molecules, needed once only / apply ecf* water molecules form hydrogen bonds ; **A** H bonds / H bonding cohesion between water molecules (in spaces) ; **A** cohesive force between water molecules cohesion to water molecules, adhering / AW, to soil, particles / clumps ; adhesion of water molecules to, soil, surface / particles / clumps / mucilage / polysaccharides ; **A** adhesive force of water molecules AVP ; e.g. clumps provide, areas / (small) spaces / place, in which water collects *idea of* stable environment e.g. reduced movement of water, in / around clumps **I** keeps water around the, soil clumps / the root tip	**3**

Q4.

(d)	*any **two** from:* hydrogen bonds between water molecules must break for water, to change state / evaporate / AW ; loss of, heat / energy for, evaporation / transpiration (will cool the, leaf / plant) ;	**2**

Q5.

(a)	*any **two** from:* **1** (water is a) solvent, for, assimilates / minerals / ions / polar molecules **A** hydrophilic **A** named **or** substances, in xylem and phloem sap / that are transported, dissolve in water / are in solution ; **A** (water is a) good / universal / versatile, solvent **2** feature for xylem ; e.g. water can move up, as part of transpiration stream ref. cohesion between water molecules adhesion between water and, cellulose / wall of xylem / xylem lining hydrogen bonds for cohesion and adhesion **I** for cohesion-tension **3** feature for phloem ; e.g. water used to build up, hydrostatic pressure / pressure gradient / pressure differences, for, mass flow / translocation / transport / AW *if not gained for mp2 allow similar ref. to cohesion / adhesion, for, phloem sap movement / transport* **4** AVP ; e.g. (xylem sap) water moving down a water potential gradient contributes to transpiration stream	**2**

Q6.

(a)	*any three from* **1** (diagram shows) hydrogen bond is a weak bond ; **2** each oxygen (atom) forms two hydrogen bonds / each hydrogen (atom) forms one hydrogen bond ; **3** (attraction) between oxygen (atom) of one water molecule and hydrogen (atom) of another (forms a hydrogen bond) ; **R** cohesion / adhesion – *if used for attraction* **4** water is dipolar ; **5** detail ; e.g. electrons not shared equally between oxygen and hydrogen **A** oxygen is more electronegative (than hydrogen) **A** *ref. to* (two) lone pair(s) (of electrons) on oxygen **A** uneven distribution of, electrons / charge e.g. oxygen has, small / slight, negative charge / δ^-, **and**, hydrogen has, small / slight, positive charge / δ^+ *only needs to state 'small' once*	**3**

(c)	*any three from* **1** dissolves / AW, ions / minerals / salts, and (named) polar molecules ; **A** 'assimilates' as polar **I** substances / nutrients **2** transports, solute(s) / named solutes / dissolved substance, in, xylem / phloem / xylem and phloem ; **3** storage of, solutes / named solutes, in vacuoles ; **4** metabolic / chemical / cellular, reactions occur in water ; **5** dissolves, carbon dioxide / oxygen, with ref to, respiration / photosynthesis;	**3**

Q7.

(f)	*any one from:* **A** and **C** are, polar / hydrophilic ; **A** has many, OH / hydroxyl groups **B** is, non-polar / hydrophobic ; **A** has, only one OH / no groups, that interact with water	**1**

Q8.

(b)	*any two from* water molecules are dipoles ; **A** polar (each water molecule has) $\sigma+$ hydrogen (atoms) and a $\sigma-$ oxygen (atom) ; the positively charged hydrogen (atom) of one water molecule is attracted to the negatively charged oxygen (atom) of another water molecule ; weak attraction between water molecules ;	**2**
(c)	*any two from* water molecules are polar ; ions are charged ; *ref.* attraction between water molecules and ions ; AVP ; e.g. oxygen $\sigma-$ faces positive ion	**2**