Hoehler_et_al_Handbook_of_Exoplanets_2018.pdf

Hoehler

Page 1

> (i) a source of energy

> (ii) elemental raw materials,

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> (iii) a solvent that supports the synthesis

> (iv) physicochemical conditions

> lists the following broad requirements for life, in decreasing order of certainty:

Is it broader than the requirements in the abstract?

Page 3

> **Specifying a particular liquid specifies a range of temperatures and pressures in which that liquid is stable and ultimately a range of distances around the host star within which a planet's radiation budget could provide suitable temperature/pressure conditions at the surface.**

[EBM] Argument on how radiation relates to the habitability via the exsitence of stabvle solvent.

> but large and structurally complex molecules often thermally decompose before acquiring sufficient kinetic energy to enter the gas phase.

The importance of liquid state: why gas state is not acceptable.

Page 4

> the stable form of low- pressure water ice is less dense than liquid water (ice floats)

Why is this a stable form? Because it will expose the ice more to the light?

> dielectric constant of about 80

> without a high dielectric solvent such as water, reversible molecular interactions would, from the standpoint of their practical significance in biochemistry, become largely irreversible

High dielectric - weak electrostatic

> This is critical in Earth's biochemistry, because most forms of intra- or intermolecular self-organizatio

Polar nature

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> hese properties make it reactive (and potentially destructive) toward several of the bond types that are common elements of our biochemistry.

Water’s weakness, especially for prebiotic stage.

Page 6

> metabolic activity has not been documented below a water activity of approximately 0.6

The importance of water activity.

Page 7

> The average oxidation state of carbon in our biochemistry is slightly less than zero, because the number of instances in which C bonds to H (and thereby decreases its oxidation state) outweighs the number of instances in which C bonds to O or N (and thereby increases its oxidation state)

Oxidation state

Bisedes O2, many other types of gases can serve as electron donors.

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> “hydrogen bonding,” which is the electrostatic attraction between a partially positive H and an unoccupied set of electrons on an N or O to which the H is not covalently bound

> nucleic acid polymers

> sugar–phosphate backbone

Page 11

> By virtue of

> **By virtue of their size, large organisms have the potential to maintain an internal temperature different from that of the environment.**

[EBM] An argument on the acceptable temperature for mammal lifes

> cytosine and guanine

> adenosine and thymine

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> nonviable

> The range of conditions tolerated by modern organisms could be significantly

> broader than the range of conditions conducive to the origin of life.

The required enviornments for maintaining the life and originate the life are different.

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> The first measure, which can be thought of as similar to voltage (e.g., volts, joules per coulomb of electrons)

> In either case, the energy delivered per unit of energy carrier must be sufficient to drive the synthesis of ATP

We even start to consider the non carbon-based biomolecules, but here why do we think ATP is a constraint?

> tangible

> The second measure has units of energy per time or power (e.g., watts, joules per second)

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> because it is thought that photosynthetic biospheres offer a higher probability of remote detec- tion.

Why?