KEY Bio12 (Intro to) Biologically Important Mollecules STUDY GUIDE

/50

1. a) 5 charac. of L'T'S: 1) made of cells 2) respond to stimuli 3) reproduce 4) evolve/adapt 5) grow 6) homeostatic.

b) Forest Fire:

Living	Non living
- grows	- not cells
- reproduce	- not homeostatic
- uses (O_2)	- dont evolve.

2. a) "Scientific Method" - process* by which we obtain data and enhance our understanding of the world around us.

* question, observe, hypoth., controlled exp.**, revise, conclusion

b) - they are repeatable ∴ can be confirmed/reconfirmed. (over & over) → removes bias/variability.

** Control = part of exp that undergoes all same treatment/steps except ONE being tested.
Dogged Exp't

3. a) Hypoth - tentative explanation of what is being observed. eg. "AIDs caused by a retrovirus" or "Microbes live on Martian Surface"

b) Theory - widely tested, successful/accepted hypoth. that can be used to predict phenom. "Theory of Nat Sel."/"Thy of Eean Relativity"

4. Control -

/3 5. answers vary. - steps should follow scientific method as outlined in chapter notes.

/2 6. Homeostasis - "activities" (physiologic/behavioral) that Lt's do in order to maintain a relatively constant, stable internal environment regardless of the ext. envir.

eg's: blood pH = 7.4, body temp = 37°C
blood press = 120/80, blood [glucose] = 0.1%.

/1 7. Negative Feedback - response to a certain stimulus dampens/cancells the stimulus that brought about the stimulus. (or) "above and below mean value"

(or) maintain int. conditions within narrow limits.

7 cont.
& 8.

Neg. Feedback eg. Body Temp Regulation.

#1

- cold on air or skin

Stimulus → Receptor (cold recep. in skin (stimulated)) → sends message to brain. → Regulator - hypothalamus. → signals various structures → Adaptive Response → Normalcy → -ve fb (cancels original signal) → Receptor

Adaptive Response:
- surface b.v. constrict
- hairs stand on end
- shivering
- move about
- sweat glands inactivate.

Normalcy:
- body & skin temp. rises + returns to normal

Neg. Feedback eg. blood [glucose] Regulation.

#2

- high blood [glucose]

Stimulus → Receptor (glucose receptors in pancreas) → Regulator -islets of Langherhans (B cells) secret insulin → Adaptive Response → Normalcy → -ve fb → Receptor

Adaptive Response:
- liver, muscle & fat cells metab glucose
- liver/muscle store glucose as glycogen

Normalcy:
- blood [gluc] ↓

9. Pos. Feedback - the response to certain stimuli that reinforces the stimuli causing an ↑ing level of responsiveness.

Stimulus (pressure on uterine walls (cervix)) → Receptor (- pressure receptor (stretch) in walls of uterus (cervix)) → Regulator - post. pituitary produces & releases oxytocin → Adaptive Response - uterine wall contracts → adds more pressure on itself (reinforces) → Positive Feedback → Receptor

* note: pressure receptors no longer stimulated when baby is born → cycle breaks.

10. Atoms - smallest unit of matter that can't be broken down chemically.

S.A particles	Proton	Neutron	Electron
location	nucleus	nucleus	orbits in outershells
charge	+	0	-

} unnecessary

Ionic Bond - bond b/t oppos. charged ions. Atoms gain or lose e-s to produce a molecule : metals donate e-s → +
non-metals accept e-s → -
eg NaCl
- weak association

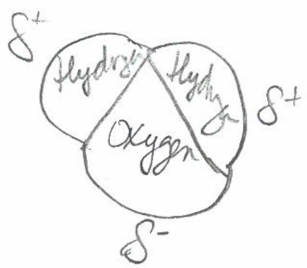
/6

Covalent Bond - atoms share pairs of elect in order to make a stable molecule

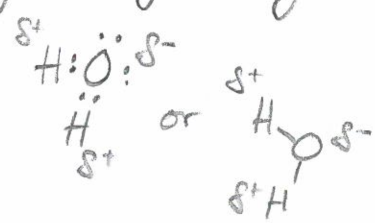
eg H_2O.

- stronger than Ionic / hydrogen

Hydrogen Bond - a weak attraction b/t the (+) charged hydrogen & an atom of another molecule carrying a neg. charge
eg: b/t H_2O molecules.

11. 

(*) imp. charact of H_2O to life.



12. Polar nature of H_2O : is important to life.
→ low f.p. & high b.p. so stays liquid @ body temp.
→ can absorb/give off much heat before temp. Δ's which allows sweat to cool v. well.
→ is cohesive ∴ clings together & draws along w/it dissolved materials for X-port.
→ is a good solvent for dissolving other polar molecules

/4

13. 0 acidic 7 basic 14.

14 Acids - cmpds that dissociate in H_2O and release H^+ ions.
- ex. HCl, H_2CO_3.
/3
- pH b/t 0 → 7. "(below 7")

15. Base - cmpd. that dissociate in H_2O and releasl OH^- ions
- ex NaOH, KOH
- pH b/t 7 → 14 (above "7")

16. Pure water is <u>neutral</u> = pH 7 <u>[H^+ ions] = [OH^- ions]</u>

17. Sea H_2O = pH 8, pure H_2O = pH 7.
acid rain = pH 2 dist H_2O pH 7.

* acid rain is 100 000 x more acidic than dist. H_2O

18. maintenance of pH crucial to lts. b/c • if pH is altered • proteins denature (Δ shape = loss of functional form) & many homeostatic mechanisms fail

/1

19. Buffer - chem. or group of chem. that resist changes in pH. by taking up (binding to) excess H^+ or OH^- ions. when an acid or base is added. Biologically imp. <u>b/c buffers resist Δ's in pH ∴ help conseve enzyme shape</u>

/2

20. Carbonic Acid Systems (Buffer) ($H_2CO_3 \leftrightarrow HCO_3^-$).

a) H^+ ions. - Carbonic Acid in blood dissociates into H^+ and HCO_3^-

$H^+ + HCO_3^- \rightarrow H_2CO_3$ (bicarb. ion)

- when more H^+ ions are released into b/stream (i.e. diet...) the bicarbonate ion (HCO_3^-) binds to the ~~excess~~ H^+ ions to form H_2CO_3 (∴ not Δ in pH as long as HCO_3^- is still available)

b) OH^- ions - "
- When OH^- " released into b/stream " H^+ binds w/it to 4m H_2O (∴ no Δ in pH).

$OH^- + H_2CO_3$ (Carbonic Acid) $\longrightarrow HCO_3^- + H_2O$.

<u>Organic Biochem:</u> cmpds of life that contain carbon.
<u>Inorganic Biochem:</u> cmpd . . . . . . do NOT " "
<u>Carbon:</u>

21. Polymer - large (macromolecule) of repeating subunits (monomers)
ex: starch, glycogen, cellulose made from many (glucose molecules)
DNA, neutral fats ... Proteins.

22. Protein Functions: - structural support (elastin / collagen)
- movement (fibres of muscles)
- enzymes (speed up rxns)
- antibodies (immunity) → fight disease.
- transport (hemoglobin for O_2 & membrane channels)
- hormones (control homeostasis ex: insulin)

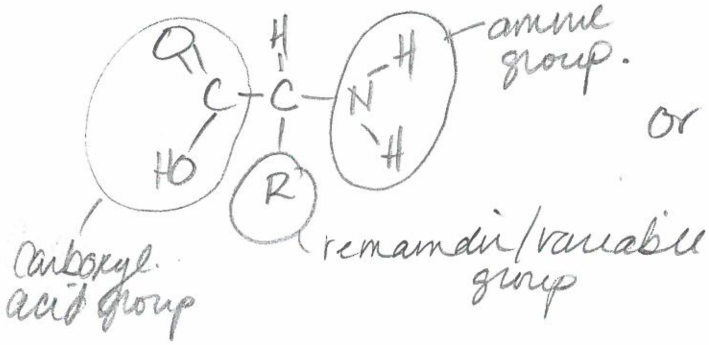
23. Proteins' Elements - C, H, O, N (P...)
↳ characteristic

*made of amino acids (monomers)

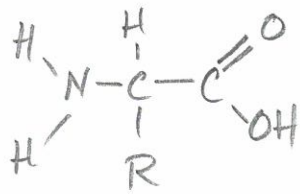
24. Amino Acid.

4

a)



or

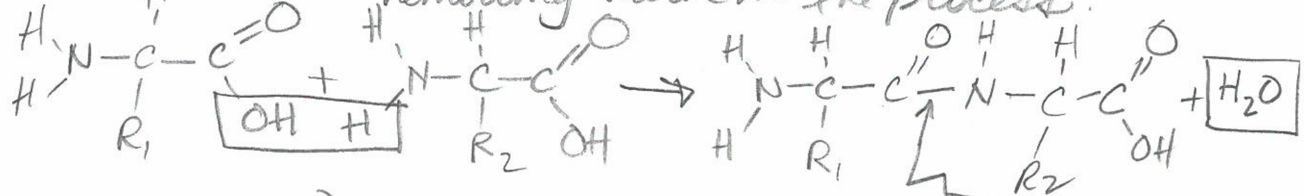


b) 20 aa in nature

c) differ in "R" group.

25. a) Dehydration Synthesis: form polymers from smaller molecules removing water in the process.

ie:

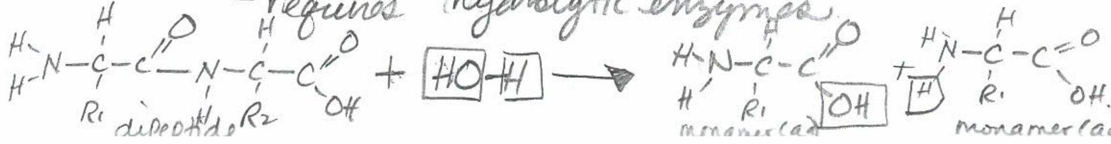


monomer (aa) + monomer (aa) → dipeptide peptide bond + H_2O

- OH- removed from carboxyl acid group of 1 aa and H^+ removed from amine group of 2nd aa 4ms peptide bond.
- this "removal" of OH^- and H^+ is the dehydration of H_2O.

b) Hydrolysis: water disrupts bonds linking units/molecules together & thus breaks them down; 1 molec of water is used / split to separate 1 bond that joins 2 units. $H-OH \rightarrow H^+$ and OH^- (one molecule takes H^+, other takes OH^-)
- requires hydrolytic enzymes.

ie.



- hydrolysis
H_2O break apart

26. Peptide Bond is formed b/t aa's.

27. Polypeptide (ppt) : > 2 aa's, but less than 20 aa's
Protein: large polypeptide chain ~> 75 aa's.

28. Levels of Protein Organization:

1° structure: linear sequence of aa's. - held together by peptide bonds

4 2° structure: peptide bond is polar ∴ H-bonding occurs b/t aa in the 1° line → chain coils into alpha helix or B-pleat

3° structure: bonding (covalent, ionic, or H) b/t "R" groups. makes α-helix / B-pleat bend & turn to form "glob." of protein (a 3D arrangement of aa chain).

4° structure: for proteins w/ more than 1 polypeptide chain it is the specific arrangement of polypep. chains (ie) hemoglobin is 4 ppt chains interlocked in a specific way.

29. 1° structure b/c that ultimately determines the final 3D shape. is determined by the linear sequence of aa.

1

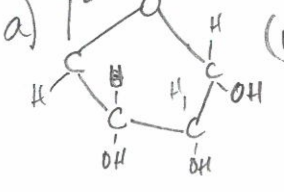
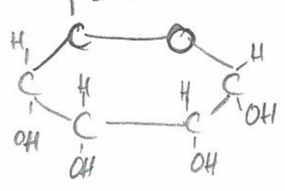
30. Denaturing : a denatured protein has lost normal structure/shape bec normal bonding b/t "R" groups has been disrupted

causes: – Δ in temp. (heating – not cooling → KMT)
– Δ in pH
– presence of heavy metals.

31. Carbohydrate : a) molecule C, H, & O / "hydrated carbon"

4 b) gen. formula $C_n(H_2O)_n$ $(CH_2O)_n$

c) main f(x)'s – short term energy supply (glucose)
– energy storage (glycogen / starch)
– cell membrane "markers"
– structural material (plant cell walls & chitin in exoskeletons)

32. a)  (ribose)  (glucose)

b) pentose - 5 carbon sugar
hexose - 6 carbon sugar

c) monosaccharide names end in "ose"

33. a) glucose 4mula: $C_6H_{12}O_6$
b) gluc. used primarily for energy source in cells → used in cellular Resp^n

34. - Monosaccharides: simple sugar - 1 molecule eg - glucose, fructose, ribose.
- Disaccharides: carb of 2 sugar molecules eg - maltose, sugrose.
- Polysaccharides: " of more than 2 monosaccharides. eg: starch, glycogen, cellulose.

35. Starch: fairly straight chains of glucose. w/ few side branches
-storage 4m used by plants.

Glycogen: many side branches of glucose (highly branched polymer of glucose)
-storage 4m of gluc. (in liver/muscles) in animals

6

Cellulose: slightly diff. linkage b/t each glucose alternating upright & inverted orientation
ie

-1° structural comp of plant cell walls

- thirds insulin/glucagon

36. liver - monitors blood content → largest internal organ ∴ holds most amt blood at any given time and can make quick adjustments in blood [glucose] by releasing glucose (glucagon - bld glycogen → glucose)
muscles - needs to bld. glyc. into glucose for activity

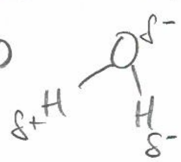
37. Lipids: a) organic cmpd C, H, O H:O = 4:1
b) f(x)'s - long term energy 9.1 cal./gram vs. 4.4 cal/gram.
- insulation
- padding of vital organs
- structural - cell membranes - phos
- chem. messengers.

c) insoluble.

d) (Fatty Acids), Neutral Fats, Phospholipids, Steroids

* 38. a) Polar molec. - have a region where atom(s) carry a charge
Non-polar molec - no charged regions.

b) H_2O



and phospholipid

polar phosphate "head" group

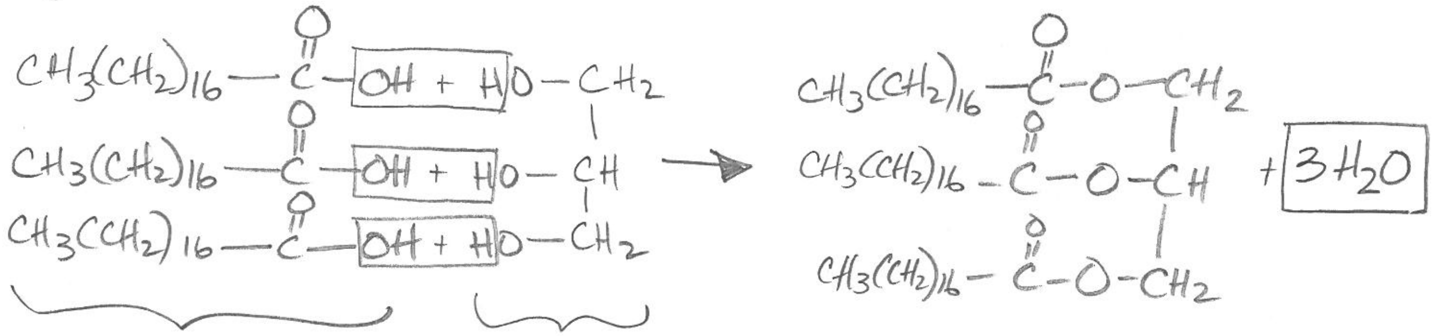
CO_2 and O_2 (non-polar)

39. hydrophobic = water fearing → non-polar
hydrophyllic = water loving → polar

40. a) 1 glycerol and 3 fattyacids b) triglycerides. c) primary f(x) of neutral fats = Energy storage.
non-polar = less reactive ∴ stores safely in body for long periods.

41. Dehydration Synthesis:

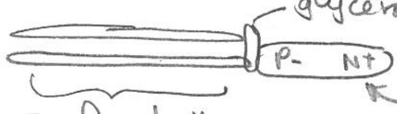
See. fig. 2.24



3 f.a. 1 glycerol.

42 a) Saturated fat: has no double bonds b/t carbons, all C's are
b) - "saturated" w/ H's, solid at room temp.
- 'bad' dietary fat assoc. w/ heart disease, ↑ BP, cancer etc...
Unsaturated fats: has 1 or more double bonds
- liquid @ room temp.

43 a) Phospholipid - major component (structural) in cell membranes
b)

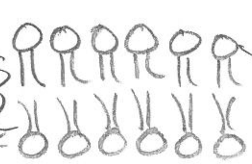


glycerol
P- N+
← charged/polar phosphate head.
2. f.a. tails

c) - same composition as a neutral fat except 3rd fa is a charged phosphate group = polar head. (P-, N+)

5

d)



tails are hydrophobic
heads are hydrophyllic
} P-lipid bilayer.

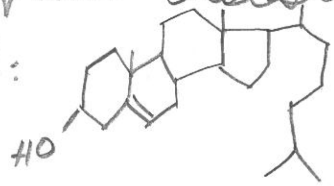
e) small, non-charged molecules, especially if they're lipid soluble, pass thru lipid bilayer easily.
ex: CO_2, H_2, O_2, Cl_2 ... *many diatomic molecules pass through freely b/c they are small and non-polar

44. a) Steroids - type of lipid derived from cholesterol that is multi-ringed

b) they f(x) as chemical messengers & important hormones that have affects on cells, tissues & organs (ie Sex hormones)

c) - derived from cholesterol.

d) Cholesterol:



e) chol. not inherently bad; found in every cell - it 4ms part of cell membranes

f) dietary cholest. (in animal products) leads to strokes & heart disease.

45. - b/c they are non-polar - don't like to mix/disperse ⇒ hydrophobic

46. - Emulsification - process of getting one liquid (ie oil) to disperse in another (ie water)

- b/d large fat droplets into small fat droplets.

47. Nuc-Acids. (f(x)'s): a) - control cell division

- control protein synthesis.

- bring about the process of evolution by undergoing mutations.

- pass on genetic instructions during reproduction of cells

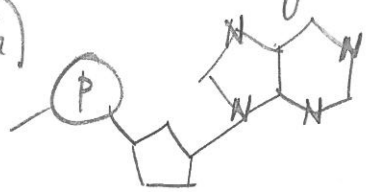
b) - 2 types of nucleic acids.

DNA: Deoxyribonucleic Acid.

RNA: Ribonucleic Acid.

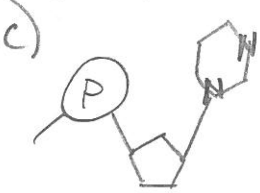
48. Nucleotides consist of a 5-carbon sugar, a phosphate & a N-base

Purine (A, G)

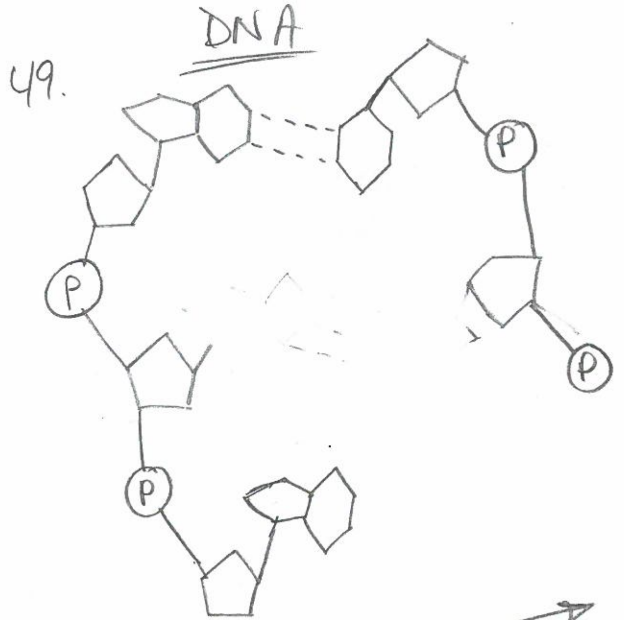


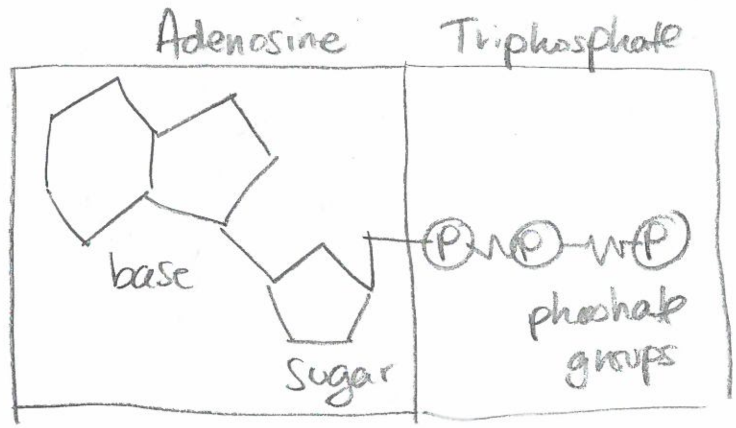
5-C sugar

Pyrimidine (T, C)



49.

49. 



50. a)   b) f(x) of ATP: primary carrier of energy in cells.
c) the Triphosphate group contains 2 high energy bonds (wavy lines)
4 d) ATP changes to ADP releasing ENERGY and a phosphate.

51.

Polymer	Summary of f(x)	Unit Molec	Sketch
Protein		a.a.	
Starch		glucose	
Glycogen	see notes	glucose	see notes
cellulose		"	
DNA		nucleotides	

Molecule	Summary of f(x)	Constituent Molec	sketch
Triglyceride	- body fat / long-term storage of en. (b/c neutral → not v. reactive)	1 glycerol 3 fa (tails)	
Phospholipid	- component of cell memb.		phosphate group glycerol 2 fa tails
Steroid	- chem. messengers - compon. of cell memb.	4 carbon rings. Cholesterol.