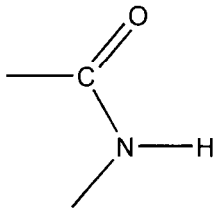
1 (a) (i) Carboxyl and amine or amino groups/ COOH and NH_2
Accept correct groups circled on diagram 1

(ii)  or similar. Accept - CONH - 1

(b) COO^- (1) both NH_2 (1) 2

(c) pH changes: sidechains in B and D (1)
lowering pH turns $-NH_2$ to $-NH_3^+$ (1) / $-COO^-$ to COOH (1)

raising pH turns - COOH into $-COO^-$ (1) / $-NH_3^+$ to NH_2 (1)
in each case possibly breaking ionic links (1)
Any two points

Heavy metal ions sidechains in B (and C/D) (1) because the metal ions can bind to COO^- / COOH /accept CH_2OH (1) AW
using nonbonded/lonepairs(1) for dative bonding (1)
Any two points.
Accept inference of correct sidechains for first mark in each case.
QWC - award 1mark for SPG unless there are four or more mistakes 7

Question total 11

2. (a) (i) By providing a lower energy/activation energy route for the reaction AW 1

(ii) Active sites (1) have precise shape(1) into which substrate molecules can fit AW
Or enzyme active site contains particular arrangement of functional groups (1) which correspond to (functional) groups on substrate(1) 2

(b)(i) Two advantages from: continuous process(1)
enzymes can be reused repeatedly(1)
product/enzyme easier to separate(1)
enzyme less sensitive to pH changes (1)
enzyme less sensitive to increased temperature (1)

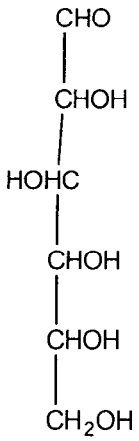
Disadvantages. enzyme activity can be reduced by immobilisation (1)
NOT expensive 3

(ii) Producing high fructose syrup from starch/penicillin production/other 1
NOT biological washing powder

Question total 7

3 (a) Both H and OH on correct carbon (1)
OH above plane of ring (1) 2

(b)



accept upside down/in landscape/with some bonds
do not expect correct orientation of each OH group

The CHO group earns (1), the rest (1) 2

(c)(i) Hydrogen bonding (1) and -OH --- O (1). Any C-H involvement loses mark
The hydrogen bond can be between OH on glucose and O on water
or between O on glucose and OH on water Accept water hydrogen bonded to two OH groups, or clear annotation on one of diagrams on the paper

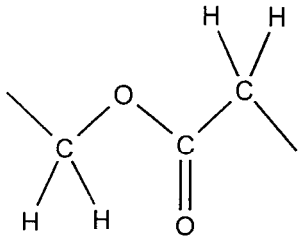
A more elaborate drawing is acceptable as long as it shows a hydrogen bond correctly. 2

(ii) More OH groups available to hydrogen bond in glucose (1)
but cyclohexanol has a non-polar end to interfere with hydrogen bonding (1) 2

(d) Less soluble (accept insoluble) /availability of glucose controlled by enzyme activity
Accept reference to lower osmotic potential 1

Question total 9

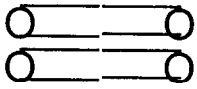
4. (a) (i)



Do not worry about bond angles or exact positions of atoms 1

(ii) Ester (NOT carbonyl) 1

(b) Bilayer (1) showing van der Waals/hydrophobic interaction (1) orientation of polar heads (1) and the idea of polar heads and non-polar tails(1) Accept hydrophilic and hydrophobic



Accept annotation for all marks above if the points are covered 4

(c) The energy comes from the complete oxidation of C and H (to carbon dioxide and water) (1). In glucose but not in lipids, each carbon is already partly oxidised (1)/ lipids contain a higher proportion of H to C (1). AW 2

Question total 8

5 (a) (i) GCAGTA 1

(ii) CGUCAU 1

(b) Any three points from:

DNA has deoxyribose	RNA has ribose
thymine /T	uracil/U
double stranded	(single strand)
helical	
larger	

@ (1) each 3

(c) m-RNA carries the codes for individual amino acids in triplets of bases, which could be implied by the diagram(1)
At ribosomes (1), t-RNA molecules (1) provide the amino acid for each m-RNA triplet in turn (1). They have the complementary triplet of bases in their structure to allow binding to m-RNA (1)- this could be shown with base pairs on the diagram
The ribosome stitches amino acids together (in the order prescribed by m-RNA) (1). AW

Annotated diagrams should show these points to earn the marks 5

Question total 10

PAPER TOTAL 45