Q1.

10 (a) any **two** of the following:

- to speed delivery (of drug to target organ), i.e. faster response
- to avoid the drug being hydrolysed/reacted/decomposed (NOT digested) in the stomach
- to allow a smaller dose to be used *or* greater accuracy of dosage
- patient does not have to be conscious

2 × [1] **[2]**

(b) (i) spheres with a diameter of the order of nanometres/in the nanometre range/between 10 & 500 nm [1]

(ii) it is (highly) acidic *or* low pH *or* contains HC*l* (NOT contains enzymes) [1]

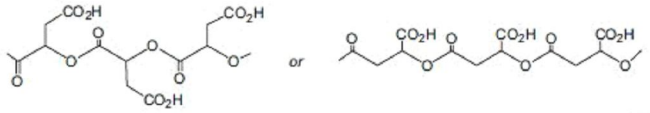
(iii) use hydrogels: of different (wall) thickness/strength (to release drug over time)
of different chemical composition (for different breakdown times)
incorporating pores/holes (in their walls) (any two) [1] + [1]

[4]

(c) for the **homopolymer**, ***either*** using the amino acid the minimum is:

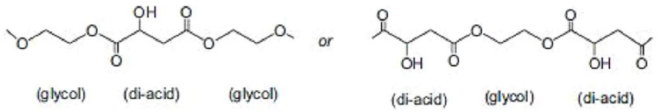
-CO-CHR-NH-CO-CHR-NH-CO-CHR-NH-

or using the hydroxyacid the minimum is:

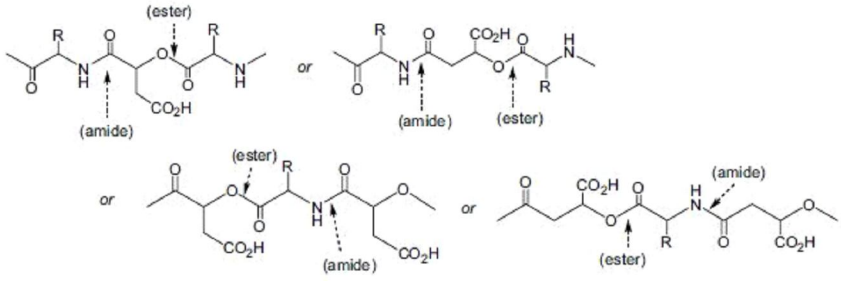


(–[1] for each error) [2]

for the **heteropolymer**, ***either*** using the glycol compound and the di-acid the minimum is:



or using the amino acid and the di-acid, the minimum is:



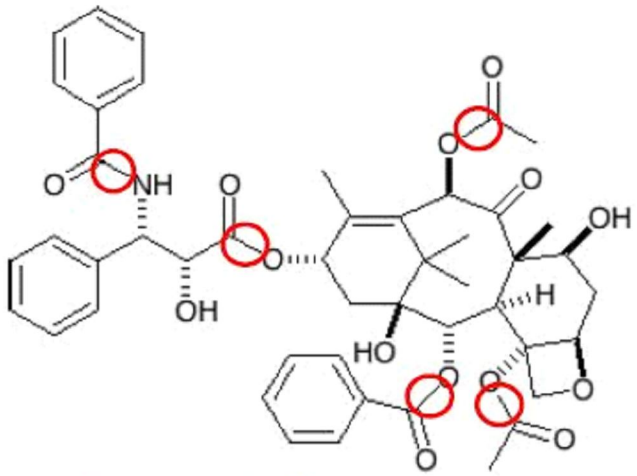
(A heteropolymer incorporating all three monomers can also be drawn. This should include an ester linkage between the glycol and one of the CO_2H groups, and an amide linkage between the aminoacid and another CO_2H group. Deduct [1] mark from the whole of section **(c)** if complete compounds are shown rather than sections of chains. Allow 4-monomer sections instead of 3. Allow [2] marks for a polymer section even if **one** end is incomplete (e.g. is lacking an oxygen atom), but if **both** ends are incomplete deduct [1]) (–[1] for each error) [2] **[4]**

[Total: 10 max 9]

Q2.

10 **(a)** ester or amide (allow nitrile) [1]

(b)



amide (1) + any one ester (1) [2]
allow whole groups circled

(c) **(i)** hydrophilic drug at **C** (1)
hydrophobic drug at **B** both needed (1)

(ii) (at **A**) the drug would be exposed to attack / breakdown / digestion (1) [3]

(d) **(i)** at one of the –OH groups (1)

(ii) volume of sphere can be large *or* one PEG molecule can only carry 1 or 2 drug molecules (1)
or can carry different types of drug [2]

(e) more economic (1)
less chance of side-effects / side effects reduced / less chance of allergic reaction (1)
less risk of harming healthy tissue / organs / less chance of an overdose (1)
(3 max 2) [2]

[Total: 10]

Q3.

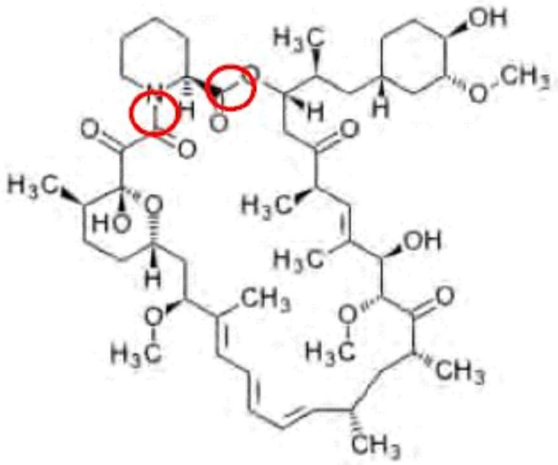
8 **(a) (i)** hydrophilic in area **C** [1]
fat-soluble in area **B** [1]

(ii) **A** – region would be exposed to the atmosphere/water/enzymes *or* nothing the molecule can attach to at **A** [1]
[3]

(b) (i) amide/peptide *or* ester [1]

(ii) hydrolysis [1]

(iii)



[1] + [1]
[4]

(c) (i) measured in nm, i.e. between 1 and 1000 nm (*or* 10^{-9} – 10^{-6} m). Any quoted value or range between these limits is acceptable [1]

(ii) One or both of the –OH groups (NOT just 'oxygen' or 'O') [1]

(iii) PEG can H-bond (with water) because it is hydrophilic/contains an OH group/contains lots of oxygen atoms [1]
[3]

[Total: 10]

Q4.

9 (a) (i) Covalent / co-ordinate (1)

(ii) Mechlorethamine – binds the two chains together (1)
– prevents unravelling (1)

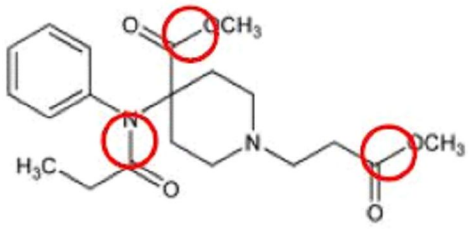
Cis-platin – binds to two Gs / bases in one chain (1)
– so they are not available for base pairing (1)

[Total: 5]

Q5.

11 (a) Any **two** from:
The drug can be localised in a part of the body (1)
Smaller doses can be given reducing cost (1)
Smaller doses can be given with fewer possible side effects (1)
More immediate action / acts faster (1) **[2]**

(b)



(May circle whole functional group)
Any 2 circles (2) **[2]**

(c) (i) Must not react with the drug *or* must not breakdown too easily/quickly (1)

(ii) The swelling/hydrolysis would begin in the stomach (and the drug would be released too soon) *or* stomach is acidic or has low pH (1) **[2]**

(d) Addition, condensation (1)
Suitable equation for addition (1)
Suitable equation for condensation (1)

(Addition equation must show polymeristion and balance – allow $nX \rightarrow X_{2n}$ or X_n or $X_{n/2}$)
(Condensation can be simple reaction e.g. to single ester or amide but must balance – 2 products)
(If polymerisation RHS must show a repeat unit but can leave out other product – HC*l* etc.)
[3]

(e) Hydrolysis (1) **[1]**

[Total: 11]

Q6.

8 **(a)** **(i)** Soluble form would be most effective [1]

(ii) **Q**, since the 'mini-pills'/granules/powder have a larger surface area
or **P**, because it has no protective casing [1]

(iii) The gel coat stops it being broken down while passing through the upper part of the digestive system/stomach
or the gel coat is stable to stomach acid. [1]
[3]

(b) The drug is taken quickly/directly to the target
or more accurate dosing can be achieved [1]

When the drug is taken by mouth it has to pass through the stomach/intestine wall to get into the bloodstream. *or* some is digested/lost to the system [1]
[2]

(c) **(i)** condensation (polymerisation) [1]

(ii) hydrogen bonds *or* van der Waals' [1]

(iii) It would change the overall shape of the (drug) molecule
The 'fit' into the active site would be less effective [1] + [1]

(iv) Hydrolysis [1]
[5]

[Total: 10]