

AQA A-LEVEL CHEMISTRY • 7405

CHEMISTRY



EXAM QUESTION PACK

3.3.13 AMINO ACIDS, PROTEINS AND DNA

SCORE

/15

PERCENTAGE

%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner reports in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports free of charge. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

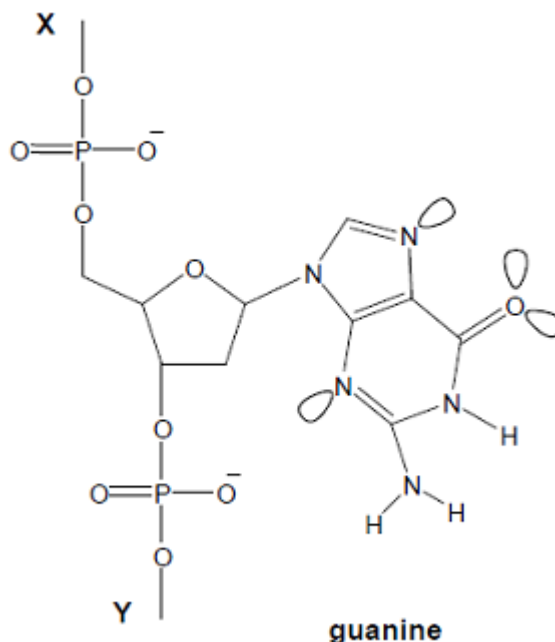
If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

The anticancer drug cisplatin operates by reacting with the guanine in DNA.

Figure 1 shows a small part of a single strand of DNA. Some lone pairs are shown.

Figure 1



- (a) The DNA chain continues with bonds at **X** and **Y**.

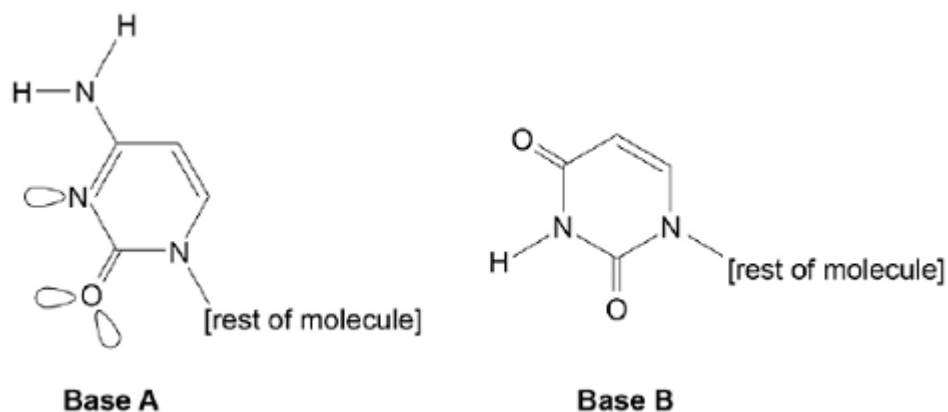
State the name of the sugar molecule that is attached to the bond at **X**.

(1)

- (b) Messenger RNA is synthesised in cells in order to transfer information from DNA. The bases in one strand of DNA pair up with the bases used to synthesise RNA.

Figure 2 shows two bases used in RNA.

Figure 2



Suggest which of the bases **A** and **B** forms a pair with guanine in **Figure 1** when

messenger RNA is synthesised.

Explain how the base that you have chosen forms a base pair with guanine.

(4)

- (c) Cisplatin works because one of the atoms on guanine can form a co-ordinate bond with platinum, replacing one of the ammonia or chloride ligands. Another atom on another guanine can also form a co-ordinate bond with the same platinum by replacing another ligand.

On **Figure 1**, draw a ring round an atom in guanine that is likely to bond to platinum.

(1)

- (d) An adverse effect of cisplatin is that it also prevents normal healthy cells from replicating.

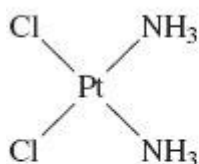
Suggest **one** way in which cisplatin can be administered so that this side effect is minimised.

(1)

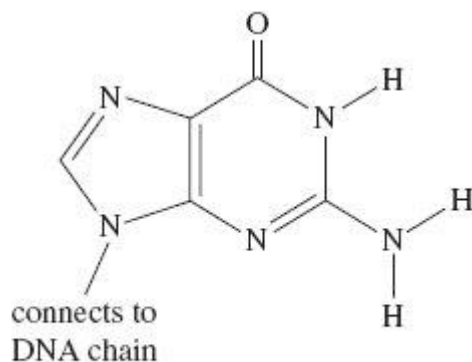
(Total 7 marks)

Q2.

The complex cisplatin acts as an anticancer drug by changing the properties of DNA when it reacts with guanine, a component of DNA.



cisplatin



guanine

When cisplatin is absorbed into the human body, it undergoes a ligand substitution reaction and one chloride ligand is replaced by a water molecule forming a complex ion **Q**.

- (a) Write an equation for this substitution reaction to form the complex ion **Q**.

_____ (2)

- (b) The complex ion **Q** can bond to guanine in two different ways.

- (i) The first way involves a hydrogen atom, from one of the ammonia ligands on **Q**, bonding to an atom in a guanine molecule. State the type of bond formed to guanine and identify an atom in guanine that could form a bond to this hydrogen atom.

Type of bond _____

Atom in guanine _____

(2)

- (ii) The second way involves a ligand substitution reaction in which an atom in a guanine molecule bonds to platinum by displacing the water molecule from **Q**. State the type of bond formed between guanine and platinum when a water molecule is displaced and identify an atom in guanine that could bond to platinum in this way.

Type of bond _____

Atom in guanine _____

(2)

- (c) State and explain **one** risk associated with the use of cisplatin as an anticancer drug.

Risk _____

Explanation _____

(2)

(Total 8 marks)

Mark schemes

Q1.

- (a) 2-deoxyribose 1
- (b) Base A
If Base B stated, allow 1 mark only for response including hydrogen bonding 1
- Top N–H forms hydrogen bonds to lone pair on O of guanine 1
- The lone pair of electrons on N bonds to H–N of guanine 1
- A lone pair of electrons on O bonds to lower H–N of guanine
Allow all 4 marks for a correct diagram showing the hydrogen bonding
Students could also answer this question using labels on the diagram 1
- (c) Allow either of the nitrogen atoms with a lone pair NOT involved in bonding to cytosine 1
- (d) Use in very small amounts / target the application to the tumour 1
- [7]**

Q2.

- (a) $\text{Pt}(\text{NH}_3)_2\text{Cl}_2 + \text{H}_2\text{O} \rightarrow [\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{H}_2\text{O})]^+ + \text{Cl}^-$
 Correct product 1
- Balanced equation 1
- (b) (i) Hydrogen bond 1
- Oxygen (or nitrogen)
Only score this mark if type of bond is correct 1
- (ii) Co-ordinate 1
- Nitrogen (or oxygen)
Bond type must be correct to score this mark but allow M2 if bond is covalent 1

- (c) Killing them or causing damage (medical side effects)
Allow any correct side effect (e.g. hair loss)
Allow kills healthy (or normal) cells

1

May attach to DNA in normal cells

1

[8]

Examiner reports

Q2.

It was very pleasing to note that most candidates made a good attempt at this unfamiliar, 'How Science Works' question. The most difficult part of the question was part 6(a) where only the best candidates could write a balanced equation showing the release of a chloride ion and the formation of a platinum complex with a single positive charge.