The use and abuse of drugs

1. Hundreds of years ago, it was thought that the cure for a disease would be found where you caught the disease.
   In 1760, The Reverend Edward Stone thought that a cure for a fever would be found in wet and boggy ground.
   One plant that grew there was the willow tree.
   He guessed that willow trees would contain a cure for a fever.
   He ground up willow tree bark and gave it as a medicine to a person suffering from the fever.
   The patient recovered.

Match words, A, B, C and D, with the numbers 1– 4 in the sentences.
A control
B hearsay
C hypothesis
D investigation

The opinion that ‘the cure for a disease would be found where you caught the disease’ is an example of . . . 1 . . . . Edward Stone’s guess that the cure was to be found in the willow tree is an example of a . . . 2 . . . . His . . . 3 . . . . involved giving ground-up bark to a patient suffering from a fever. He could not be sure that it was the bark that had cured the fever because he did not use a . . . 4 . . . .
2. In each part choose only one answer.

The chart shows the main stages involved in the development of a new drug.

![Chart showing drug development stages](chart.png)

A  How long after the end of the discovery and evaluation stage did it take to get final approval for the drug’s use?
   1  8 years
   2  9½ years
   3  10 years
   4  14½ years

B  How long was the drug in clinical trial phases?
   1  7½ years
   2  8 years
   3  8½ years
   4  10½ years
C  At which stage would the drug first be tested to find out whether it was toxic?
   1  during clinical trials
   2  when it was discovered
   3  during laboratory testing
   4  during review and approval

D  When clinical trials of a new drug are carried out, half of the volunteers are given a placebo (a pill which does not contain the drug).
   What is the purpose of this?
   1  so that only the dependent variable is changed
   2  so that the results from both groups of the volunteers are the same
   3  so that the results of the trial are due only to the drug being tested
   4  so that the trial is carried out on a random basis

3.  Thalidomide is a drug that caused severe side effects in many people when it was first used.
   (a)  Thalidomide was developed . . .
        1  to relieve morning sickness.
        2  as a sleeping pill.
        3  as a painkiller.
        4  as a recreational drug.
   (b)  The problems arose when thalidomide was used with pregnant women.
        This was because . . .
        1  the drug had been banned for use with women who were pregnant.
        2  women were taking it without a prescription.
        3  it had not been tested with women who were pregnant.
        4  cheaper versions of the drug were being sold.
   (c)  The first signs of a problem were when . . .
        1  women developed morning sickness.
        2  women had multiple births.
        3  babies were born with low birth weight.
        4  babies were born with limb abnormalities.
   (d)  Thalidomide is now used to treat . . .
        1  leprosy.
        2  diabetes.
        3  rubella.
        4  MRSA.
Cardiovascular disease is a major cause of death. Two drugs which can be used to treat this disease are statins and aspirin. Read the article.

<table>
<thead>
<tr>
<th>Statins</th>
<th>Aspirin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statins are produced by drug companies after carrying out extensive studies on their effectiveness.</td>
<td>Aspirin has been freely available on the market for many years. It was extracted from the bark of willow trees hundreds of years ago and used to treat fever. It is now made artificially.</td>
</tr>
<tr>
<td>In these studies, 30,000 patients were monitored over several years. Statins were found to reduce the rate of non-fatal heart attacks by about 30%.</td>
<td>Treatment with aspirin can cost as little as £10 per year. In a study of 1000 patients, aspirin was found to cause bleeding of the stomach in around 0.5% of patients and there was a slightly increased risk of poor blood clotting.</td>
</tr>
<tr>
<td>Approximately 0.1% of the patients suffered serious muscle damage and 0.01% suffered kidney failure.</td>
<td>Aspirin was found to reduce the risk of non-fatal heart attacks by 31%.</td>
</tr>
<tr>
<td>The cost of treating patients with statins can vary between £150 and £500 per year, depending on the type of heart condition being treated.</td>
<td></td>
</tr>
</tbody>
</table>

A  In the study on statins, how many patients suffered from serious muscle damage?
1 3
2 30
3 300
4 3000

B  It is possible that the information about statins is biased. This is because . . .
1 a balanced account of the advantages and disadvantages of statins is not given.
2 scientists working for the drug companies have a vested interest in promoting the company.
3 there were insufficient patients in the study to come to a firm conclusion.
4 the status of the scientists may not be sufficiently high for the results to be accepted.

C  Some health experts suggest that aspirin is a better treatment than statins because . . .
1 aspirin has been used for much longer than statins.
2 aspirin has similar effectiveness to statins but is much cheaper.
3 aspirin is more effective than statins in reducing the risk of non-fatal heart attacks.
4 aspirin is less likely to cause side-effects.

D  The risk of suffering from cardiovascular disease can be increased by . . .
1 increasing the amount of exercise taken.
2 increasing the amount of LDL-cholesterol in the diet.
3 increasing the amount of polyunsaturated fats in the diet.
4 increasing the amount of non-processed food in the diet.
5. Testing a new drug on healthy humans is regarded as essential before making it widely available for the treatment of patients.

(a) Drug trials do not . . .
1 establish how effective a drug is at treating a particular illness.
2 find out what method is best for giving the patient the drug.
3 identify any possible side effects that result from being given the drug.
4 prove that a drug is completely safe for use by the general public.

(b) During drug trials, some patients are given a placebo. Who knows which patients are being given the placebo?
1 the patients only
2 the doctors only
3 both patients and doctors
4 neither patients nor doctors

In 2006, six healthy young men suffered massive unexpected reactions to the drug TGN1412 given to them in a UK drug trial. Their reactions were severe enough to make some of them critically ill.

(c) The severe reaction to the drug that was observed with the six male volunteers had not been seen when the drug was given to laboratory animals. This suggests that . . .
1 all drugs will produce reactions of this magnitude if not administered correctly.
2 it is important to use animals whose body chemistry is as similar as possible to that of humans.
3 testing drugs on animals should be stopped altogether.
4 testing drugs on animals is a waste of resources.

(d) Appropriate doses of a drug need to be established through clinical trials before the drug can be marketed. This is done by trialling new drugs on human volunteers. Which of the following would reduce the risks to volunteers?
1 giving all volunteers a different dose of the drug at the same time as each other
2 giving all volunteers increasing doses of the drug at the same time as each other
3 giving each volunteer a different dose of the drug at the same time as each other
4 giving each volunteer a different dose of the drug at a different time from the others

6. In each part choose only one answer.

The drug Bupropion has been used for many years as a treatment for depression. It was suggested that Bupropion could be used to help people to stop smoking.

Research was carried out to see if the drug did help smokers to give up smoking.

A The suggestion that the drug could be used to help people stop smoking probably came from
1 a drug company that decided to test the drug on people who smoked.
2 a scientist who thought that it might be a good idea.
3 patients who lost their craving for tobacco after being given Bupropion.
4 researchers, as a result of tests carried out on animals.
Trials were carried out to find out if the drug did help people to stop smoking.

Which of the following groups of volunteers would it be best to use in the trials?

1. a large group of adult smokers
2. a large group of male and female smokers suffering from depression
3. a large group of male teenage smokers
4. one large group of smokers and one large group of non-smokers suffering from depression

How would the drug have been used in the trial?

1. The drug would have been given to all the volunteers.
2. The drug would have been given to all the volunteers and half of them would have been told to stop smoking.
3. The drug would have been given to half the volunteers and a placebo given to the other half.
4. The drug would have been given to half the volunteers with nothing given to the other half.

Which of the following would make the results of the trials less valid?

1. the volunteers all having different weights
2. some of the volunteers developing side-effects
3. some of the volunteers suffering from depression
4. some of the volunteers using nicotine patches in addition to taking Bupropion

Digitalis is a toxin which is extracted from plants such as foxgloves.

Digitalis can be used to treat patients who are likely to suffer from heart failure.

Digitalis affects the rate of heartbeat and the volume of blood pumped per heartbeat.
The table shows the effect of using different concentrations of digitalis on the heart action of a male patient.

<table>
<thead>
<tr>
<th>Concentration of digitalis in arbitrary units</th>
<th>Mean rate of heartbeat in beats per minute</th>
<th>Mean volume of blood pumped per heartbeat in cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>136</td>
<td>35</td>
</tr>
<tr>
<td>10</td>
<td>120</td>
<td>46</td>
</tr>
<tr>
<td>20</td>
<td>103</td>
<td>54</td>
</tr>
<tr>
<td>30</td>
<td>71</td>
<td>59</td>
</tr>
<tr>
<td>40</td>
<td>59</td>
<td>62</td>
</tr>
<tr>
<td>50</td>
<td>47</td>
<td>63</td>
</tr>
</tbody>
</table>

A If 20 arbitrary units of digitalis were used on this patient, the amount of blood pumped by his heart, at rest, would be . . .
1 1.91 cm³ per minute
2 5.15 cm³ per minute
3 2060.0 cm³ per minute
4 5562.0 cm³ per minute

B Which one of the following best describes the effect that increasing the dose of digitalis has on the activity of the heart?

<table>
<thead>
<tr>
<th>Effect on heart rate</th>
<th>Effect on volume of blood pumped per beat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 increase</td>
<td>increase</td>
</tr>
<tr>
<td>2 increase</td>
<td>decrease</td>
</tr>
<tr>
<td>3 decrease</td>
<td>decrease</td>
</tr>
<tr>
<td>4 decrease</td>
<td>increase</td>
</tr>
</tbody>
</table>

C It would be unsafe to use the results from this patient to decide the dose for other patients because . . .
1 digitalis has not been trialled on human volunteers.
2 side-effects may harm the patient.
3 the sample size is not large enough to draw clear conclusions.
4 drug companies may put undue weight on the results from the first patient.

D Which of the following best describes the term ‘toxin’?
1 a chemical that affects the heart
2 a poisonous substance
3 a substance produced by a plant
4 a useful drug
8. Some athletes use drugs containing the steroid testosterone to improve their performance. Athletic authorities have banned testosterone. The authorities test athletes for use of testosterone. Using testosterone can result in serious side effects.

A Science magazine and a UK TV channel jointly sponsored an investigation into the effectiveness of testosterone. Both of the sponsors reported the results of the investigation.

In the investigation:
- scientists monitored the performance of 18 male athletes over a 6 week training programme
- 9 athletes were given weekly injections of testosterone. The dose of 3.5 milligrams per kilogram of body mass, for 6 weeks
- the other 9 athletes were given a placebo
- the athletes’ performance on a bench press exercise was measured at 3 weeks and 6 weeks.

The graph shows the results of the investigation.

(a) The data would have been better presented as a bar chart. Explain why.

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(b) Suggest what was given as a placebo in this investigation.

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(c) Describe the results of the investigation.

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(2)

(d) Most internet advertisements for testosterone state that athletes need to use testosterone for at least 10 weeks to significantly improve performance. Do the results of this investigation support the statement in the advertisements? Draw a ring around your answer. Yes / No

Give one reason for your answer.

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(1)

(Total 5 marks)