



ADVANCED SUBSIDIARY GCE
HUMAN BIOLOGY
 Growth, Development and Disease

F222/TEST

Candidates answer on the Question Paper

OCR Supplied Materials:

- Advance Notice (inserted)

Other Materials Required:

- Electronic Calculator
- Ruler (cm/mm)

Tuesday 12 January 2010
Morning

Duration: 1 hour 45 minutes



Candidate Forename		Candidate Surname	
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Centre Number							Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **100**.
- You are advised to show all the steps in any calculations.
- You may use an electronic calculator.



Where you see this icon you will be awarded marks for the quality of written communication in your answer.

- This document consists of **24** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 This question is based on the case study ‘**SIR AUSTIN BRADFORD HILL – THE FATHER OF EPIDEMIOLOGY**’ (Case Study 1).

(a) Using the information in the case study, give **one** example of each of the following terms:

(i) mortality **rate**;

.....
.....
..... [2]

(ii) an infectious disease;

..... [1]

(iii) a non-infectious disease.

..... [1]

(b) The case study refers to the ‘Million Death Study’ as a **prospective study**.

Using the information in the case study, suggest what is meant by the term **prospective study**.

.....
.....
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.....
.....
..... [3]

- (c) The first study on the possible link between lung cancer and smoking was carried out in London hospitals using 650 male patients.

State **and** explain **two** precautions that were taken in the design of this study in order to produce a **valid** conclusion.

Precaution 1

Explanation

Precaution 2

Explanation

..... [4]

- (d) Some of the results of the study on the effect of smoking in male British doctors are shown in Fig. 1.1. The graph shows the percentage of doctors surviving up to the age of 100 and compares smokers with non-smokers.

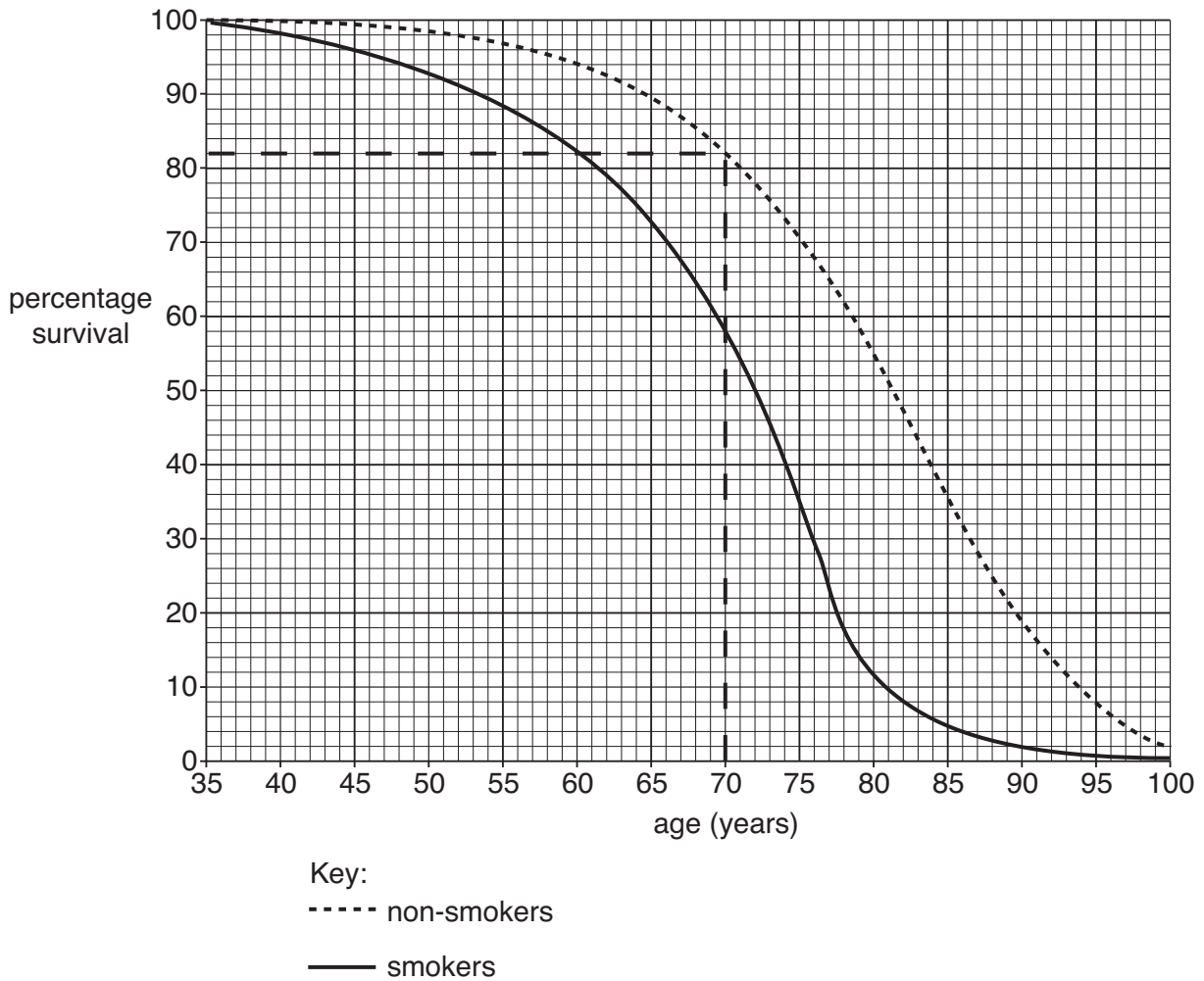


Fig. 1.1

- (i) Using the information in Fig. 1.1, calculate the number of **deaths** that would have occurred in **smokers** at 70 years of age from a random sample of 1 000 doctors.

Show your working.

Answer = [2]

- (ii) At age 70, 82% of non-smokers had survived. By comparing this to the age at which 82% of **smokers** had survived, it is possible to calculate how many years of life were lost due to smoking-related diseases.

Using Fig.1.1, state how many years of life were lost due to smoking-related diseases.

Answer = years of life lost [1]

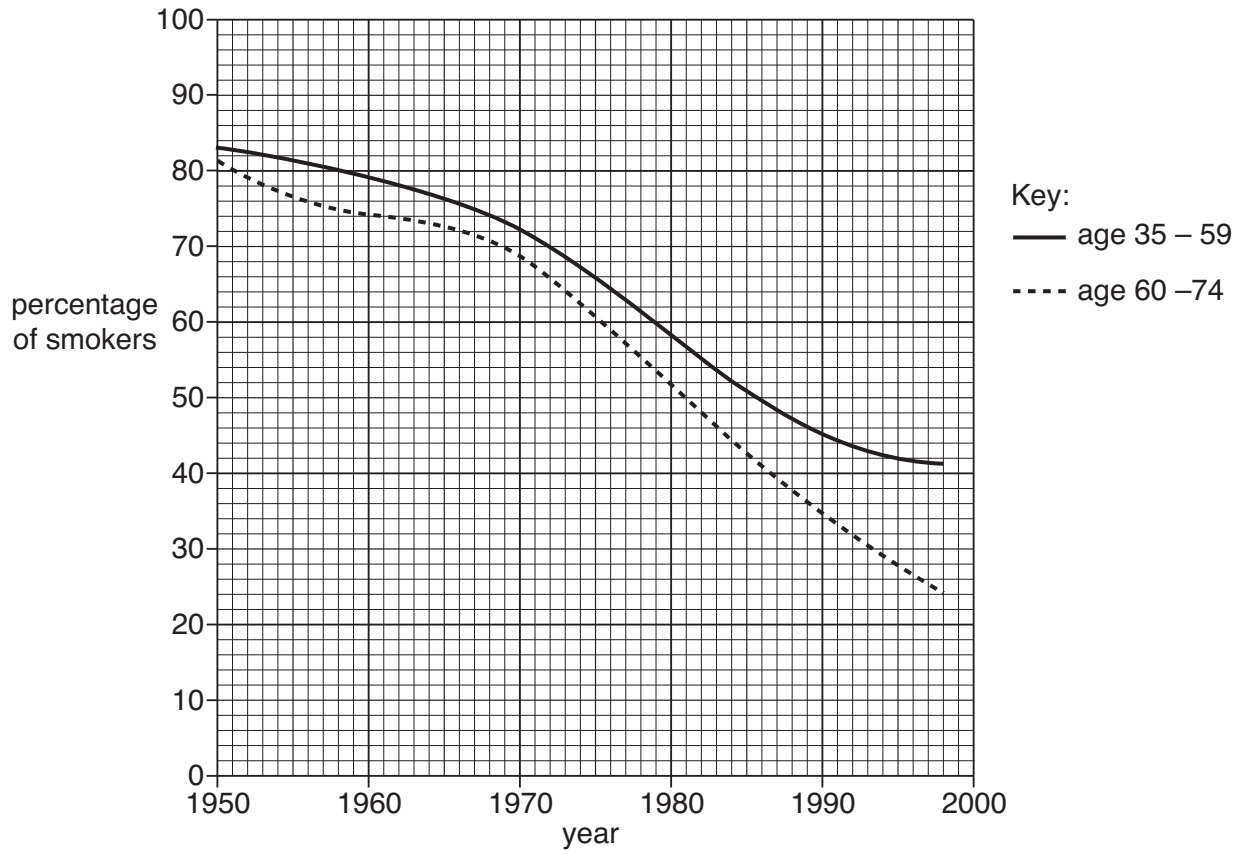


Fig. 1.2

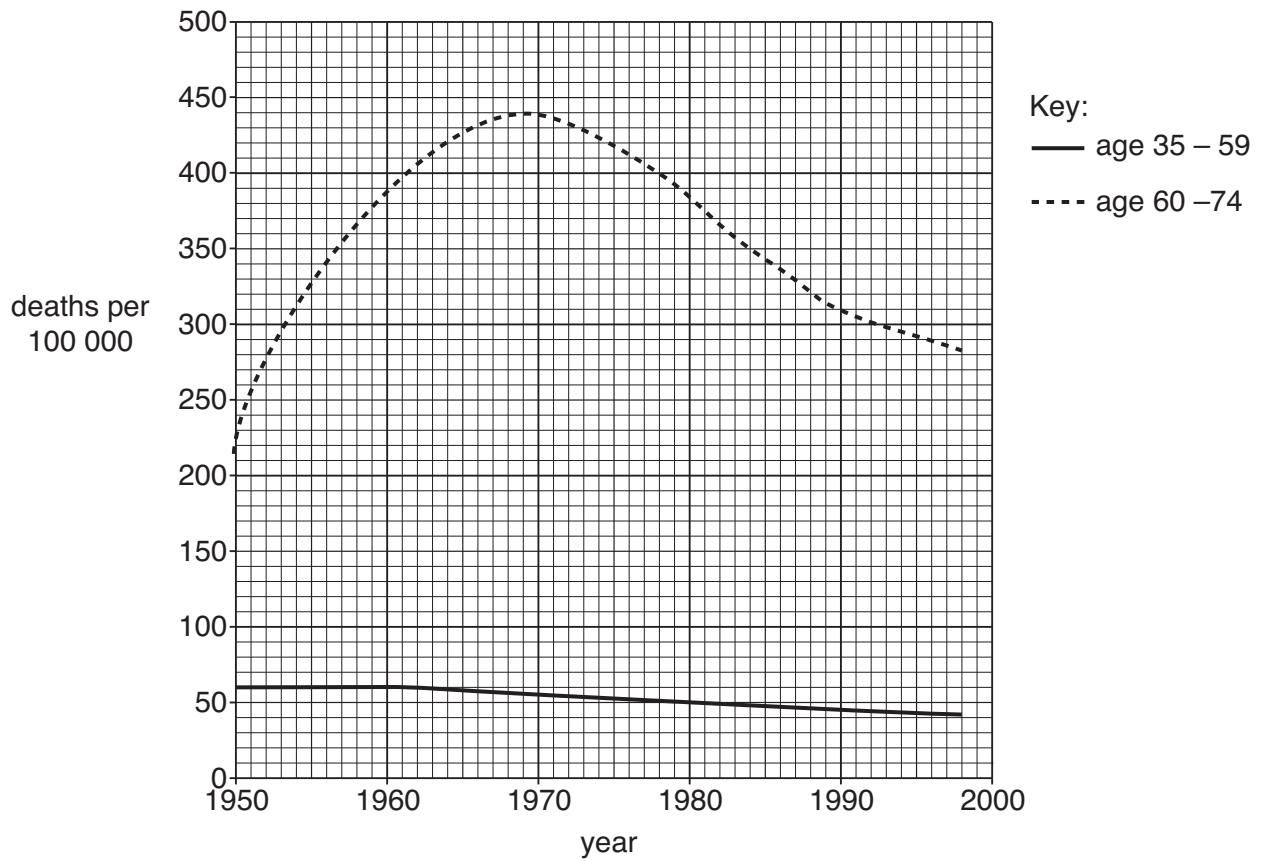


Fig. 1.3

- (e) In the case study, you were told about the Bradford Hill criteria for epidemiological studies. One of the criteria is **'temporality'**. Temporality means that the cause must come before the effect.

Fig. 1.2 on page 6 shows the change in the number of smokers in two different age groups between 1950 and 1998.

Fig. 1.3 on page 6 shows the number of deaths from lung cancer over the same period.

- (i) Describe the changes in the number of deaths from lung cancer from 1950 to 1998. You should use information from Fig. 1.3 to support your answer.

.....
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.....
.....
.....
.....
..... [3]

- (ii) Bradford Hill's criterion of 'temporality' suggests that a fall in the number of people smoking should lead to a fall in the number of deaths due to lung cancer.

Suggest **one** reason why a consistent fall in the percentage of smokers aged 60 – 74 (**Fig. 1.2**) did **not immediately** cause a similar fall in the death rate in 60 – 74 year olds (**Fig. 1.3**).

.....
.....
..... [1]

- (f) Give **two** symptoms of lung cancer.

.....
.....
..... [2]

[Total: 20]

2 This question is based on the case study '**GETTING TO THE HEART OF THE MYSTERY – AN ANALYTICAL TOXICOLOGIST TAKES THE STAGE**' (Case Study 2).

In the case study, you are told that garlic, *Allium sativum*, can be used to treat infections.

Garlic could be useful in the management of infectious diseases.

(a) What is meant by the term *infectious disease*?

.....

..... [2]

Studies have been carried out on the effect of garlic on the growth of bacteria.

A summary of the method used in one such study is given below.

- An extract of garlic is prepared.
- Agar plates are prepared.
- A suspension of bacteria is spread over the surface of each agar plate.
- Wells are cut into each agar plate.
- Garlic extract or a known antibiotic is placed in each well.
- The plates are incubated at 30°C for 24 hours.
- The size of the zone of inhibition around each well is measured.

Fig. 2.1 is a diagram of an agar plate from the above study following incubation.

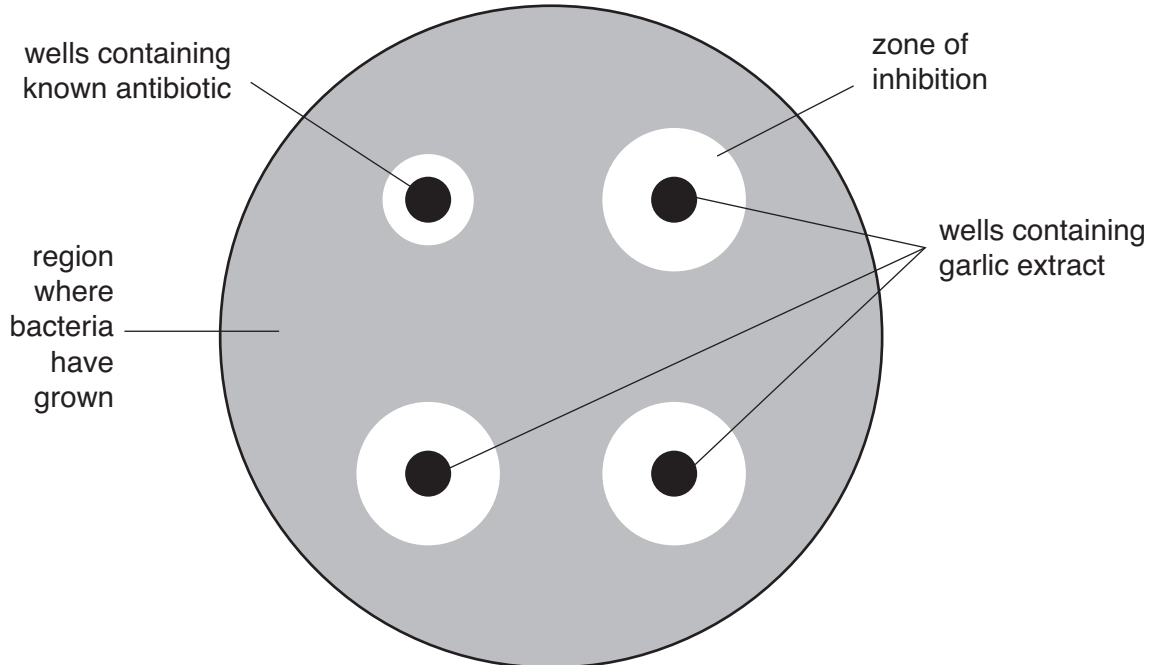


Fig. 2.1

(b) Explain why a known antibiotic was included in the experiment.

.....
.....
.....
..... [2]

(c) Scientists have used DNA markers to identify species of plant with medicinal properties such as antibiotic activity.

(i) Similar experiments to the one shown in Fig. 2.1 have been carried out using onion, *Allium cepa*, instead of garlic, *Allium sativum*.

Suggest what the likely conclusions from such experiments using onion would be. Give a reason for your suggestion.

.....
.....
.....
..... [2]

(ii) Suggest **two advantages** of using DNA markers to identify plants with antibiotic activity rather than using the method shown in Fig. 2.1.

.....
.....
.....
..... [2]

(d) You are told in Case Study 2 that some poisons produce symptoms that ‘can look like heart problems’.

(i) Explain the difference between a *heart attack* and *cardiac arrest*.

.....
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.....
..... [2]

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QUESTION 3 STARTS ON PAGE 12

3 Fig. 3.1 is a diagram of a DNA nucleotide.

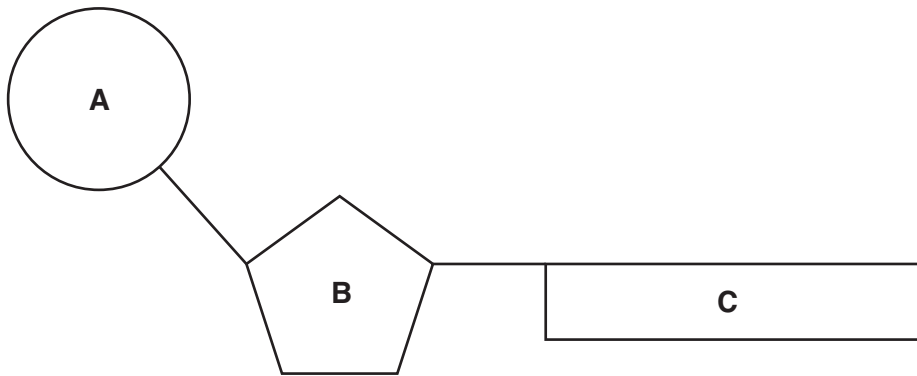


Fig. 3.1

(a) Identify the parts of the DNA nucleotide labelled **A** and **B**.

A

B [2]

(b) (i) The part labelled **C** in Fig. 3.1 is a nitrogenous base.

Some of the evidence used by Watson and Crick to describe a model for the structure of DNA was produced by Edwin Chargaff. Chargaff analysed the nitrogenous base composition of DNA from a number of species.

The percentage of adenine present in Chargaff's analysis of **human** DNA is given in Fig. 3.2.

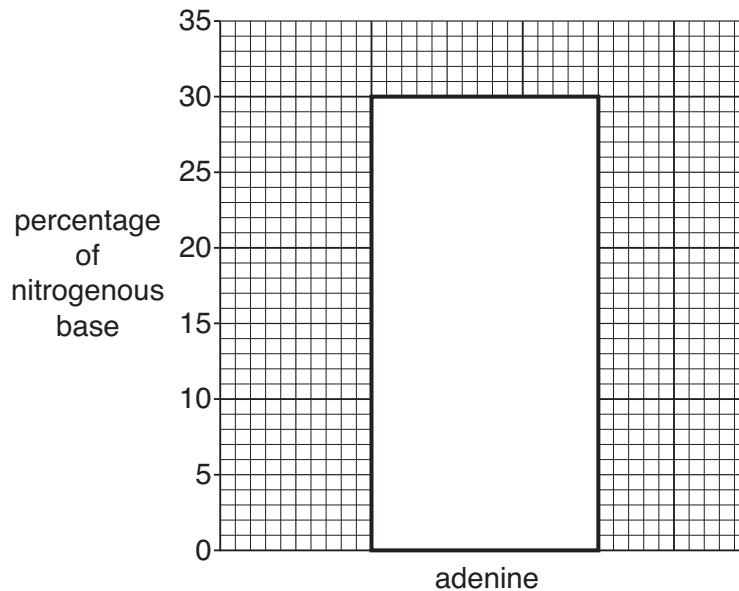


Fig. 3.2

Using the information in Fig. 3.2, summarise Chargaff's results for the base composition of human DNA by completing the table below.

name of base	type of base	percentage of base found in human DNA
adenine	purine	
		30
cytosine	pyrimidine	

[7]

(ii) Explain the importance of hydrogen bonding in the structure of a molecule of DNA.

.....

.....

.....

.....

.....

.....

..... [3]

(c) Chargaff investigated the DNA of species other than humans. These species included other animals, plants, fungi and bacteria.

(i) State **one** difference in the **location** of DNA in bacterial cells compared with its location in animal, plant and fungal cells.

..... [1]

(ii) State **one** difference, **other than location**, in the DNA found in bacterial cells compared to that found in animal, plant and fungal cells.

..... [1]

(d) In his analysis of the base composition of DNA, Chargaff found that animal, plant, fungal and bacterial DNA all showed similar relationships between the four bases.

Some viruses do **not** show this same relationship between the four bases in their nucleic acids. Suggest why.

.....

..... [1]

[Total: 15]

Turn over

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4 (a) The following statements are descriptions of events during nuclear division by mitosis and meiosis in human cells.

- A chromosomes condense
- B chromosomes pair up
- C centromeres split
- D spindles form
- E homologous chromosomes separate
- F chromatids separate

Complete the following table to indicate whether the events described by statements **A** to **F** occur in mitosis, meiosis I and meiosis II. Place a tick (✓) in the box if the event does occur or a cross (✗) in the box if the event does not occur.

The first row has been completed for you.

statement	mitosis	meiosis I	meiosis II
A	✓	✓	✗
B			
C			
D			
E			
F			

[5]

Mitosis and meiosis both occur as part of the cell cycle. The remainder of the cell cycle (interphase) can be split into stages.

In G1, DNA is checked, for example, for changes in its structure.

(b) (i) State the name given to a change in the structure of DNA.

..... [1]

(ii) Name **two** substances that can cause changes in the structure of DNA.

1

2 [2]

If changes in the structure of DNA are detected during G1, the cell cycle is halted until DNA is repaired. The protein p53 is a key part of the checking process.

Fig. 4.1 is a simplified flow chart showing the sequence of events that occurs after a change in the structure of DNA is detected.

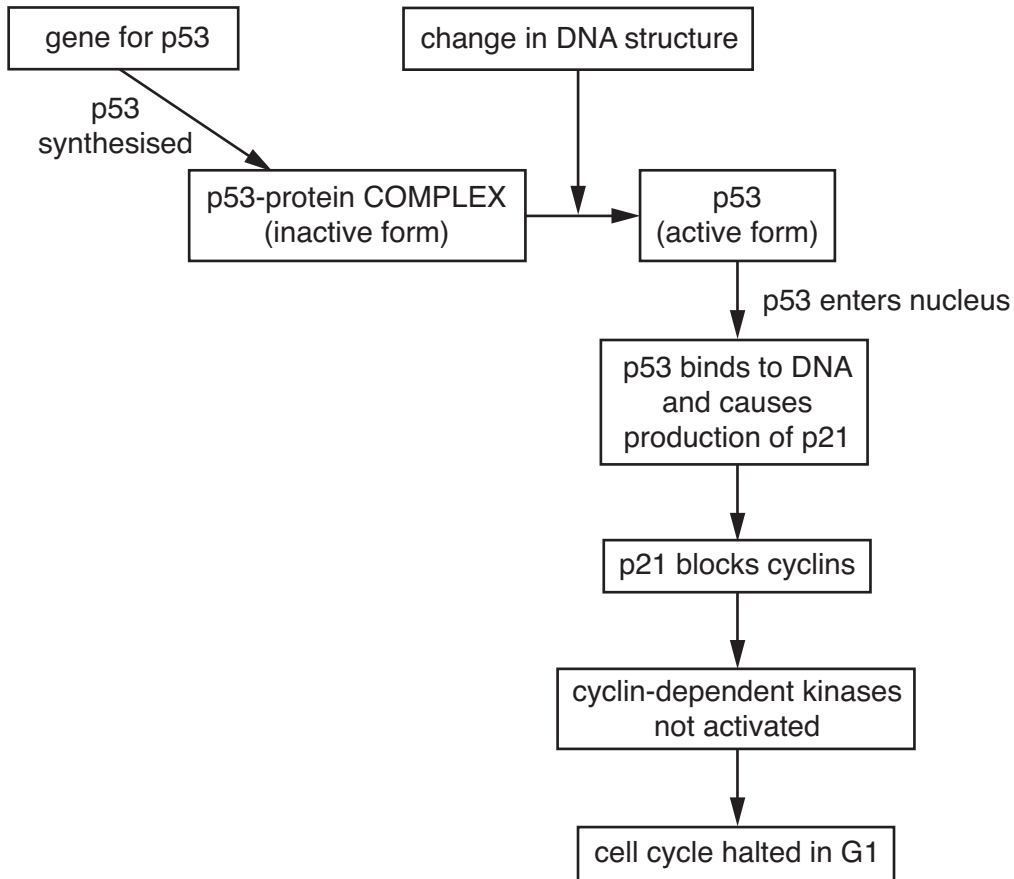


Fig. 4.1

(c) In the inactive form, p53 is attached to a second protein to form a complex. In the active form, p53 is no longer attached to a second protein.

(i) Suggest the route by which the active form of p53 enters the nucleus.

..... [1]

(ii) Suggest **why** only the active form of p53 can enter the nucleus.

.....

 [2]

(d) Cyclin-dependent kinases (CDKs) control the activity of the cell cycle. They bind to a second protein known as a cyclin. The binding of the two proteins causes the CDK to change shape and become active.

(i) Suggest what **type** of protein a cyclin-dependent kinase might be.

..... [1]

(ii) Explain why a change of shape in a protein such as CDK could affect its **activity**.

.....
..... [1]

(e) Using the information in Fig. 4.1, explain how damage to the p53 **gene** could lead to cells continuing to divide.



In your answer you should organise information clearly and coherently, using specialist vocabulary when appropriate.

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..... [5]

(f) Suggest why many forms of cancer involve damage to the p53 gene.

.....
.....
.....
..... [2]

[Total: 20]

- 5 A programme of childhood vaccinations is carried out in the UK. Different vaccines are given at different stages during childhood.

(a) Explain what is meant by the term *vaccine*.

..... [1]

- (b) Table 5.1 is a summary of part of the vaccination programme in the UK. The table shows some of the diseases that children are vaccinated against at different ages.

Some of the diseases in the table are named. Some other diseases are represented by the letters **A** to **F**.

Table 5.1

age of child	diseases vaccinated against
two months	polio diphtheria disease A disease B pneumococcal infection <i>Haemophilus influenza</i> type B (Hib)
three months	polio diphtheria disease A disease B disease C Hib
four months	polio diphtheria disease A disease B disease C pneumococcal infection Hib
12 months	disease C Hib
13 months	pneumococcal infection disease D disease E disease F

Name the diseases **A – F** from Table 5.1.

- A
- B
- C
- D
- E
- F..... [6]

(c) In 2004, the Department of Health announced a change to the polio vaccine. The ‘live’ polio vaccine was replaced by an inactivated polio vaccine (IPV).

(i) Suggest **one** way in which the IPV differs from the ‘live’ polio vaccine.
.....
..... [1]

(ii) Suggest **one** advantage and **one** disadvantage of using the ‘live’ polio vaccine.
Advantage

.....
.....

Disadvantage

.....
..... [2]

(d) In 2008, the Department of Health announced the introduction of a programme to vaccinate girls aged from 12 to 13 against HPV.

(i) Give the full name for HPV.
..... [1]

(ii) Why is the vaccine only being offered to girls?
.....
..... [2]

(e) **Outline** the ethical issues related to vaccinating girls aged from 12 to 13 against HPV.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 16]

(b) The following steps are carried out in the production of a karyotype.

Explain the **reason** for each step.

(i) First, cells are treated with phytohemagglutinin (a chemical from kidney beans).

.....
..... [1]

(ii) Cells are then treated with colchicine.

.....
..... [2]

(iii) Cells are then placed in a dilute salt solution.

.....
..... [1]

(iv) Finally, stain is added.

.....
..... [1]

[Total: 11]

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