The gas exchange system and Smoking

Question Paper 8

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Gas exchange and smoking
Sub Topic	The gas exchange system and Smoking
Booklet	Theory
Paper Type	Question Paper 8

Time Allowed : **89 minutes**

Score : **/ 74**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Fig. 6.1 is an electron micrograph of a cancer cell in the process of dividing by mitosis.

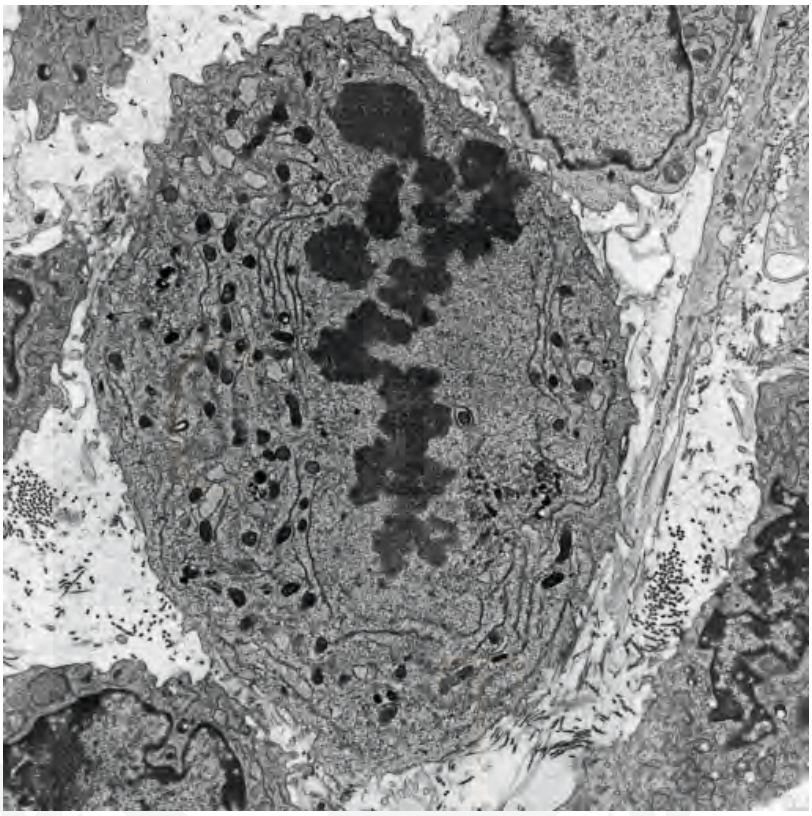

Fig. 6.1

(a) The stage of mitosis visible in Fig. 6.1 is metaphase.

State which features of the cell shown in Fig. 6.1 indicate that it is at metaphase and not at anaphase.

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(b) People who have smoked cigarettes for many years are at risk of developing lung cancer.

Describe how cigarette smoke is responsible for the development of lung cancer.

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..... [4]

(c) Fig. 6.2 shows the change in the percentage of smokers in the male population of the UK between 1950 and 2005.

Fig. 6.3 shows the change in mortality rate in the UK in men aged 75 to 84 between 1950 and 2005.

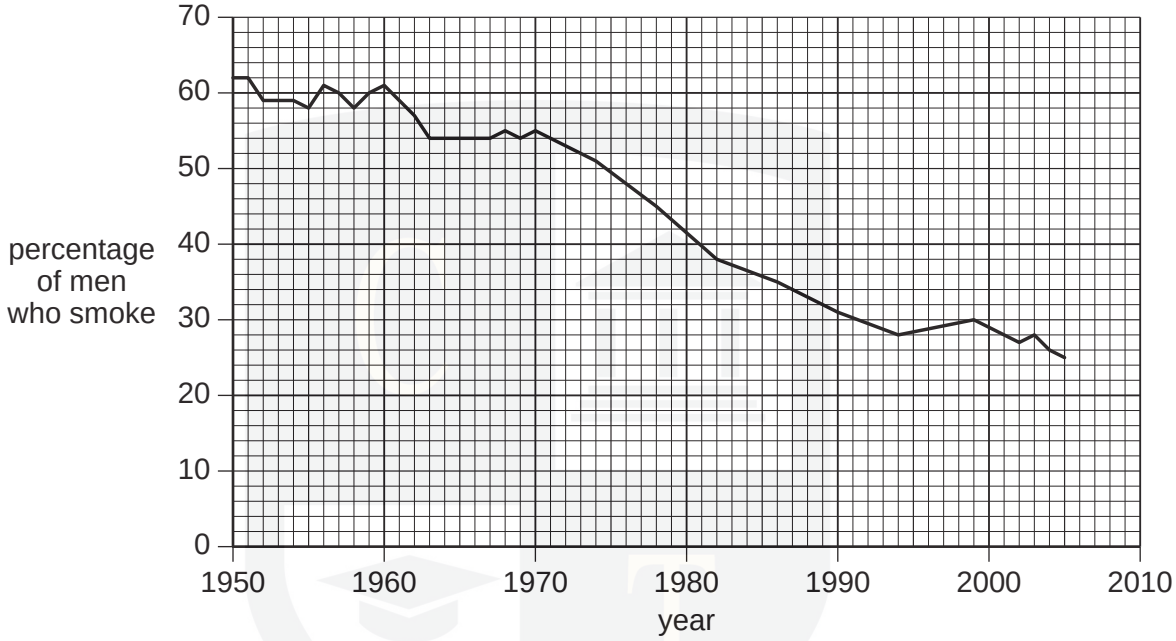

Fig. 6.2

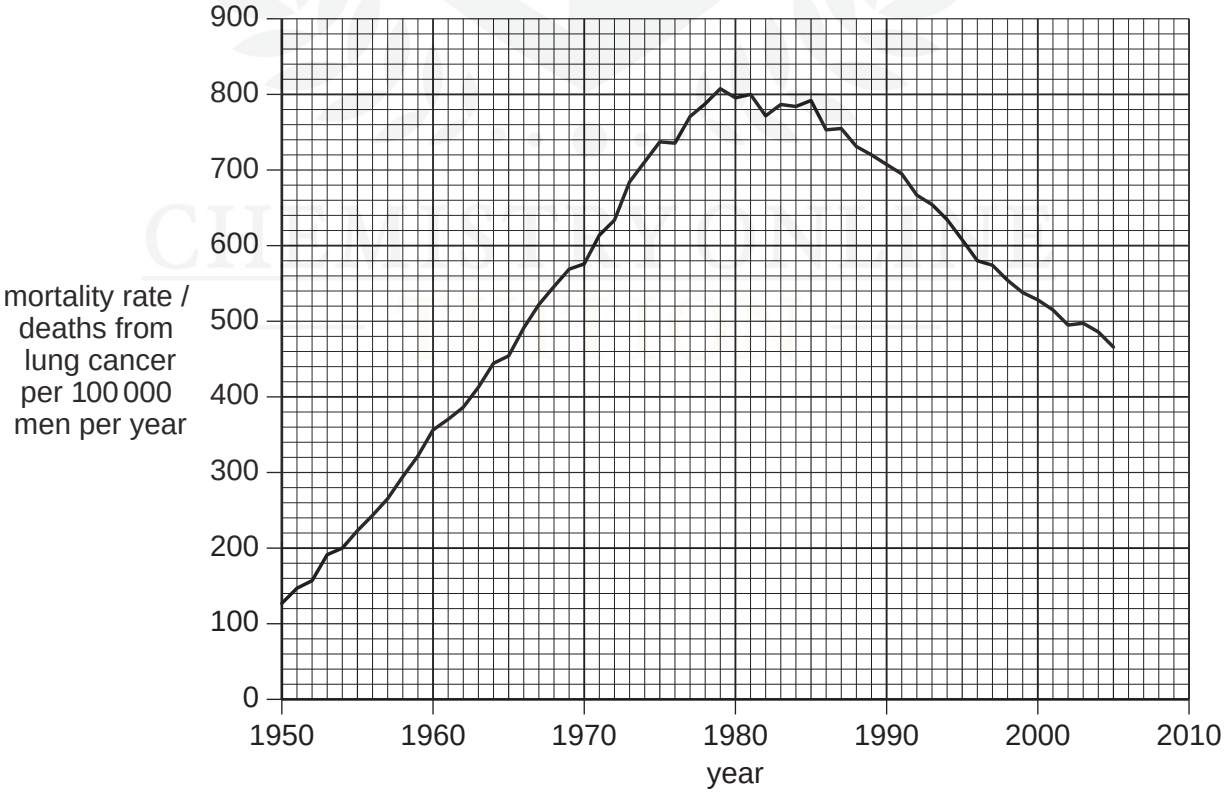

Fig. 6.3

Fig. 6.2 and Fig. 6.3 appear to show that there is no link between the percentage of the population that smoke and the death rate from lung cancer.

Explain why the mortality rate from lung cancer among men increased and then decreased over the period shown in Fig. 6.3, even though the percentage of smokers decreased over the same period of time.

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[Total: 9]

2 **(a)** Substances are exchanged between the plasma, tissue fluid, lymph and red blood cells.

Complete the table below to show which of the statements apply to each of these components of the body.

Fill in each box using a tick (✓) to show that the statement applies or a cross (✗) if it does not. The first row has been completed for you.

statement	plasma	tissue fluid	lymph	cytoplasm of red blood cells
formed by leakage from capillaries	✗	✔		✗
contains haemoglobin				
contains water				
contains antibodies				
in direct contact with muscle cells				

[4]

(b) Nicotine is the drug in tobacco smoke.

State **two** effects of nicotine on the cardiovascular system.

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..... [2]

Table 6.1 shows information on smoking and lung cancer in six countries.

Table 6.1 shows:

- the percentage of male and female adults who smoke regularly in each country;
- the death rates from lung cancer expressed as deaths per 100 000 of the population of each country.

Table 6.1

country	percentage of the population who smoke		deaths from lung cancer / deaths per 100 000	
	males	females	males	females
China	53.4	4.0	22.7	10.5
France	33.0	21.0	73.3	14.4
Malaysia	49.2	3.5	5.6	2.3
New Zealand	25.1	24.8	47.3	29.2
South Africa	43.8	11.7	13.8	5.4
Trinidad and Tobago	42.1	8.0	12.3	4.2

(c) Explain whether or not there is any evidence in Table 6.1 to support the following statements.
Use the data in the table to support your answer.

Men are more at risk of dying from lung cancer than women.

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Countries where a high percentage of the population smoke have high death rates from lung cancer.

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(d) Table 6.1 shows that a larger percentage of men in some countries, such as Malaysia, smoke compared with New Zealand. It also shows that the death rate from lung cancer for men in Malaysia is much lower.

Suggest **two other** pieces of information about men who smoke that would be useful in evaluating the risks of developing lung cancer.

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2 .....

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[Total: 11]

3 There are many types of amino acids, but only twenty that are polymerised to make polypeptides and proteins in animals.

(a) Name the type of chemical reaction that occurs when two amino acids form a dipeptide.

..... [1]

(b) Fig. 3.1 shows two amino acids, glycine and valine. Use the space below to make a drawing to show what happens when these two molecules join together to form a dipeptide.

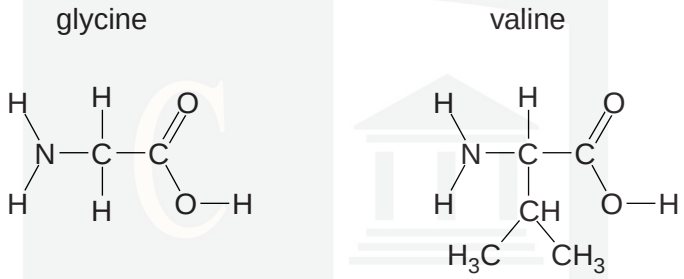

Fig. 3.1

[4]

(c) Angiotensinogen is an inactive protein molecule. When blood pressure decreases, part of angiotensinogen is removed to form a short polypeptide, angiotensin that stimulates an increase in blood pressure.

Fig. 3.2 shows the base sequence within the gene for angiotensinogen that codes for this short polypeptide, the RNA codons and the primary structure of angiotensin.

DNA base sequence	CTA	GCA	CAA	ATG	TAG	GTG	GGG	…….
RNA codons	……..	CGU	……..	UAC	AUC	CAC	CCC	UUC
polypeptide primary structure	Asp	Arg	Val	Tyr	Ile	His	Pro	Phe

Fig. 3.2

(i) Complete Fig. 3.2 to show the missing DNA triplet and the RNA codons. [1]

(ii) State the full name of the type of RNA shown in Fig. 3.2.

..... [1]

Table 3.1 shows the blood pressure in the right ventricle and in the pulmonary artery of a person who is in good health.

Table 3.1

phase of cardiac cycle	blood pressure / kPa	
	right ventricle	pulmonary artery
Ventricular systole	3.33	3.33
Ventricular diastole	0.67	1.33

(d) Use the information in Table 3.1 to explain why the blood pressure in the pulmonary artery is the same as the pressure in the right ventricle during systole, but higher during diastole.

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(e) People with long-term chronic obstructive pulmonary disease (COPD) usually have blood which is poorly oxygenated during its passage through the lungs. This leads to a constriction of blood vessels in the lungs.

Suggest the likely effect of this on the heart.

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(f) Describe the signs and symptoms of COPD that help doctors make an early diagnosis of this condition.

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[Total: 14]

4 **(a)** Nicotine, in cigarette smoke, is highly addictive. A nicotine vaccine has been developed to try and reduce the effects of addiction. The vaccine stimulates an immune response to produce antibodies that bind to the nicotine molecule. Fig. 6.1 is a diagram of an antibody molecule.

On Fig. 6.1:

- label **three** structural features that enable an antibody molecule to carry out its function.
- next to each label, state the function of the feature.

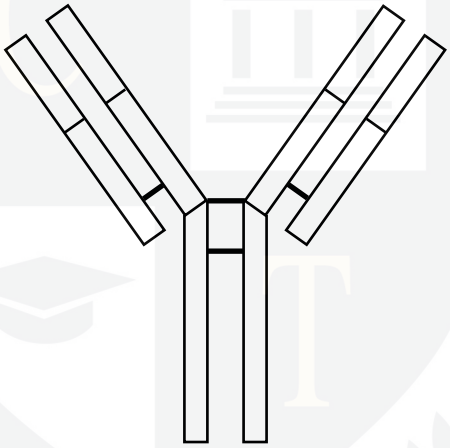

Fig. 6.1

[3]

(b) Nicotine has an effect on the cardiovascular system, such as making platelets sticky, so causing blood to clot. This increases the risk of thrombosis and reduces blood flow.

Outline **other** effects of nicotine on the cardiovascular system.

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[Total: 6]

5 Fig. 3.1 is an electron micrograph of a lymphocyte in the process of cell division during an immune response.

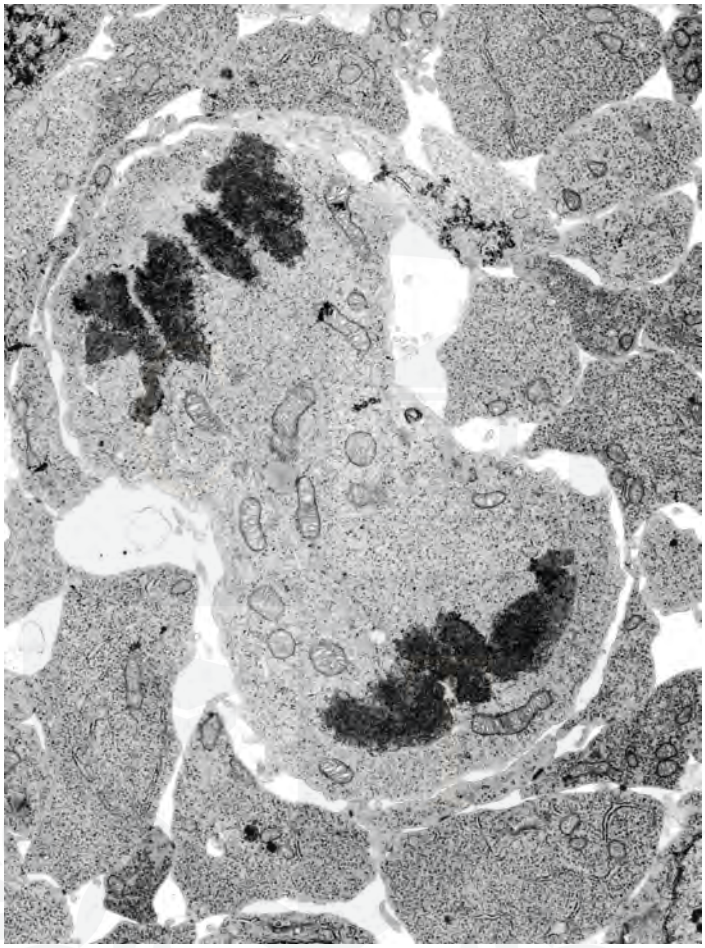

Fig. 3.1

(a) With reference to Fig. 3.1,

(i) name the stage of mitosis shown;

.....[1]

(ii) describe what is happening during this stage of mitosis;

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.....[2]

(iii) suggest the **disadvantages** of using an electron microscope to study mitosis.

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.....[2]

(b) Tumours may form inside the lungs of long-term smokers.

(i) Describe how a tumour develops in the lungs.

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(ii) Describe two signs or symptoms of lung cancer.

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[Total: 10]

6 Fig. 2.1 shows the CFTR (cystic fibrosis transmembrane conductance regulator) protein in a plasma (cell surface) membrane.

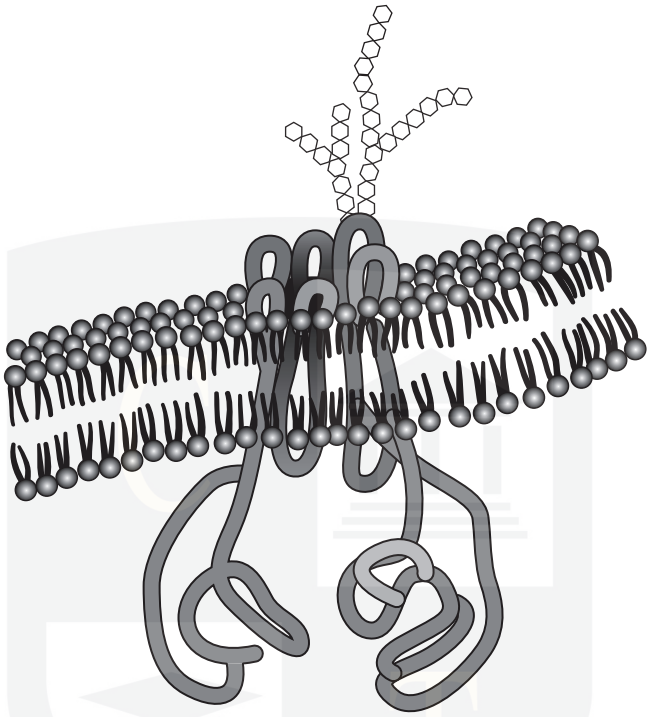

Fig. 2.1

(a) (Describe the normal function of the CFTR protein.

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(ii) On Fig. 2.1, use the letter **E** to indicate the external face of the membrane. State how you identified this face.

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.....[1]

(b) Cystic fibrosis is caused by a recessive allele of the *CFTR* gene.

(i) Explain the meaning of the term *recessive allele*.

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(ii) Explain how cystic fibrosis affects the function of the lungs.

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.....[3]

(c) As cystic fibrosis is caused by a recessive allele of a single gene, it is a good candidate for gene therapy. Trials were undertaken in the 1990s, attempting to deliver the normal allele of the *CFTR* gene into cells of the respiratory tract, using viruses or liposomes as vectors.

Explain how viruses deliver the allele into cells.

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.....[2]

(d) In some people with cystic fibrosis, the allele has a single-base mutation which produces a 'nonsense' (stop) codon within the gene.

(i) Explain how this mutation would prevent normal CFTR protein being produced.

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..... [2]

(ii) A new type of drug, PTC124, enables translation to continue through the nonsense codon. Trials in mice homozygous for a *CFTR* allele containing the nonsense codon have found that animals treated with PTC124 produce normal CFTR protein in their cells. The drug is taken orally, and is readily taken up into cells all over the body.

Using your knowledge of the progress towards successful gene therapy for cystic fibrosis, suggest why PTC124 could be a simpler and more reliable treatment for this disease.

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..... [3]

[Total: 15]

7 Fig. 1.1 is a photomicrograph of a transverse section of an artery and a vein from a mammal.

Fig. 1.1

(a) State three ways, **visible in Fig. 1.1**, in which the artery differs from the vein.

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(b) The lungs contain arteries, veins and capillaries.

Explain the role of capillaries in the lungs.

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(c) Describe the effect of tar from cigarettes on the lining of the gaseous exchange system.

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[Total: 9]