

- 3 Infertility reduces the chance of successful fertilisation of the egg by a sperm cell. There are many causes of infertility in humans.

One cause of infertility is cigarette smoking. Men who smoke cigarettes have a 30% higher risk of infertility.

Cigarette smoke contains nicotine. The effects of nicotine on the quality of sperm cells have been studied in rats.

Male rats were given nicotine at levels of either 0.5 mg per kg of body mass or 1.0 mg per kg of body mass.

The sperm cells produced by these rats were compared with sperm cells produced by a control group of rats. The rats in the control group were not exposed to nicotine. The defects in the sperm cells produced were recorded and the results are shown in the table below.

Type of sperm cell	Percentage of each type of sperm cell (%)		
	Control	0.5 mg of nicotine per kg	1.0 mg of nicotine per kg
normal sperm cells	93.6	83.2	75.2
sperm cells with flagella defects	3.9		19.9
sperm cells with mid-piece defects	2.0	2.7	3.7
other defects, including missing heads	0.5	1.0	1.2

- (a) (i) Complete the table to give the percentage of sperm cells with flagella defects when the rats were given 0.5 mg of nicotine per kg of body mass.

(1)



(1)

(1)

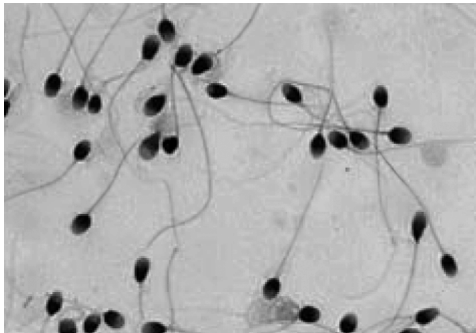
(4)



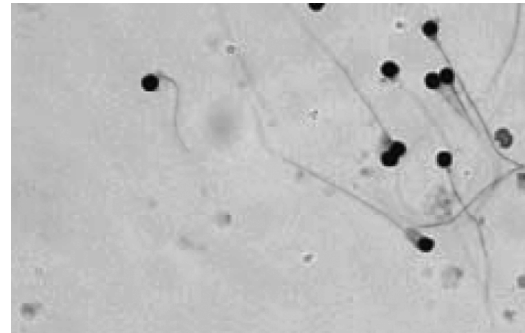
(b) A genetic cause of infertility is globozoospermia.

This condition results in round-headed sperm cells being produced. These sperm cells do not possess an acrosome.

Photograph **A** shows normal sperm cells and photograph **B** shows sperm cells from a man with globozoospermia.



**A**



**B**

Magnification  $\times 500$

Suggest why the sperm cells in photograph **B** would not be able to fertilise an egg.

(3)

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(c) Suggest why a valid study on the effects of globozoospermia on fertility would have to be carried out on non-smokers.

(3)

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**(Total for Question 3 = 13 marks)**

