Module 10

A1 Sickle-cell anaemia is a recessive disease that results in fatality during adolescence. If two sickle-cell carriers mate, what percentage of adults would be homozygous?

A 25%
B 33%
C 50%
D 75%

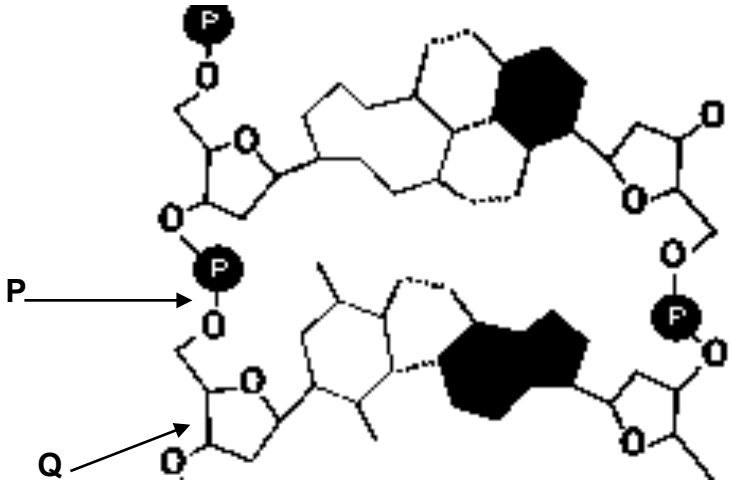
A2 When a strand of DNA was analysed for its base composition, it was found that 250 of its nucleotides contain adenine. If this makes up 20% of the total nucleotides present in the DNA molecule, how many cytosine strands are there in the molecule?

A 125
B 250
C 375
D 650

A3 Which of these parts of the male reproductive system will store inactive sperms?

A testis
B scrotum
C cowper's gland
D epididymis

B1 The figure shows part of a DNA molecule.



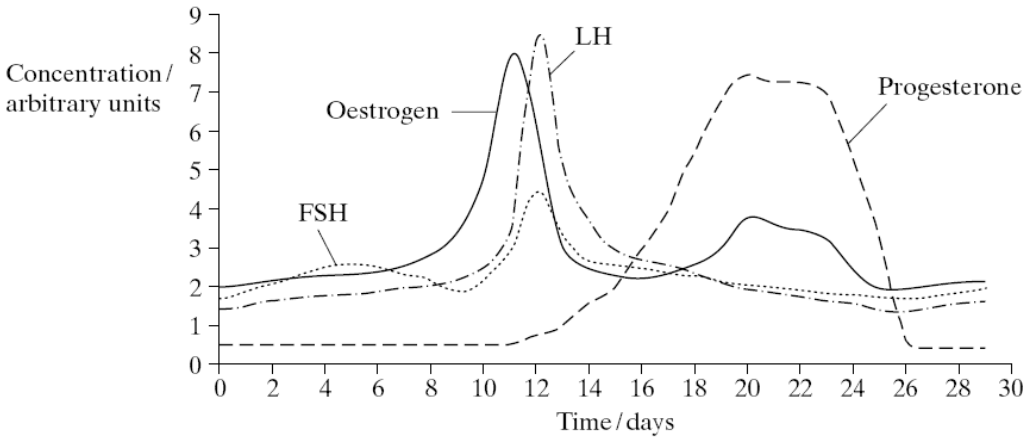
(a) What are parts P and Q?

(b) How are the two strands of DNA are linked together?

(c) Write the complementary bases for the following sequence.
A T G G C A T G C A T

(d) Chemical analysis of a sample of DNA showed that 40% of the nitrogenous bases were guanine. What percentage was adenine?

B2 The graph shows how the concentrations of various hormones in a woman's blood varied during one menstrual cycle.



(a) Based on the graph, determine the time when ovulation occurs. Why?

(b) Suggest why sexual intercourse at any time between days 10 and 14 could have resulted in fertilisation of an ovum.

(c) Oestrogen is present in some contraceptive pills. Explain how oestrogen acts as a contraceptive.

(d) What are the differences in (i) number, (ii) structure and (iii) activity between the male and female gametes of humans?

B3 The coat colour of leopards and panthers is controlled by a single pair of alleles. The allele, A, for a spotted coat (leopard) is dominant over the allele, a, for a black coat (panther).

(i) A pure-breeding leopard having two dominant alleles is crossbred with a panther. All the offspring are leopards. Explain this.

(ii) Two of these offspring are allowed to breed with each other. Draw a genetic diagram to show the ratio of leopards to panthers that would be expected. Show genotypes and phenotypes in your diagrams.

Module 10 (Solutions)

A1 Sickle-cell anaemia is a recessive disease that results in fatality during adolescence. If two sickle-cell carriers mate, what percentage of adults would be homozygous? C

A2 When a strand of DNA was analysed for its base composition, it was found that 250 of its nucleotides contain adenine. If this makes up 20% of the total nucleotides present in the DNA molecule, how many cytosine strands are there in the molecule?

Ratio between two base-pairs in DNA are always 1:1.

If there are 250 adenine (20%), there will be 250 thymine (20%). Therefore, 500 bases makes up 40%.

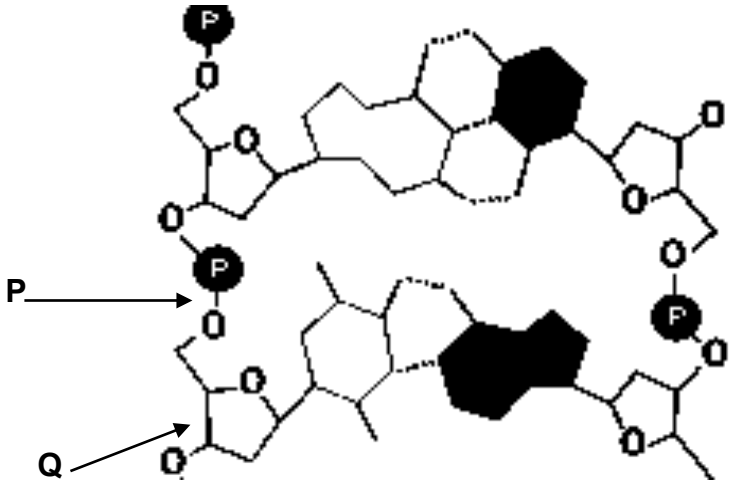
The remaining 60% are cytosine and guanine. Each of the two bases makes up 30% of the DNA.

Hence, 250 / 2 * 3 = 375 cytosines.

The answer is C.

A3 Which of these parts of the male reproductive system will store inactive sperms? D.

B1 The figure shows part of a DNA molecule.



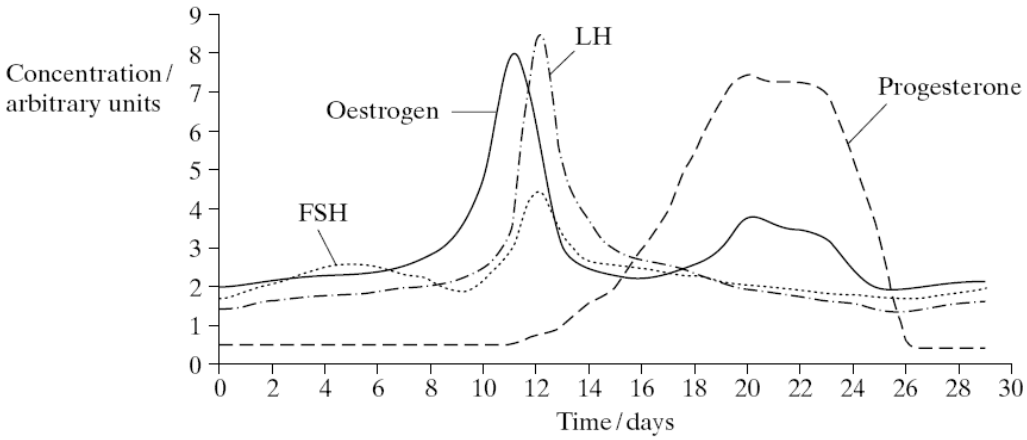
(e) What are parts P and Q?
P is the phosphate group, while Q is the pentose sugar.

(f) How are the two strands of DNA are linked together? Hydrogen bonding.

(g) Write the complementary bases for the following sequence.
T A A T C G A C C G T A

(h) Chemical analysis of a sample of DNA showed that 40% of the nitrogenous bases were guanine. What percentage was adenine? 10%.

B2 The graph shows how the concentrations of various hormones in a woman's blood varied during one menstrual cycle.



(a) Based on the graph, determine the time when ovulation occurs. Why?
Day 12. Concentration of LH hormone is the highest, which is responsible for ovulation.

(b) Suggest why sexual intercourse at any time between days 10 and 14 could have resulted in fertilisation of an ovum.

The period is fertile. Sperm and eggs can survive for 2 – 3 days and hence, fertilisation is possible.

(c) Oestrogen is present in some contraceptive pills. Explain how oestrogen acts as a contraceptive.

High level of oestrogen ensures uterine lining is always thick and prevents shedding of inner linings in uterus *via* mensutration. Also, it inhibits follice from forming.

(d) What are the differences in (i) number, (ii) structure and (iii) activity between the male and female gametes of humans?

	Male gamete (Sperm)	Female gamete (Ovum)
(i) number	About 100 million sperms released per ejaculation	1 egg released at each ovulation, per month.
(ii) structure	Head, middle piece, tail	Spherical
(iii) activity	Flagellum made movement possible to allow sperm to swim towards ovum.	Movement depends on the cilia in the oviduct (fallopian tube).

B3 The coat colour of leopards and panthers is controlled by a single pair of alleles. The allele, A, for a spotted coat (leopard) is dominant over the allele, a, for a black coat (panther).

(a) A pure-breeding leopard having two dominant alleles is crossbred with a panther. All the offspring are leopards. Explain this.

Panther has a genotype of aa (black coat), while Leopard has a genotype of AA (spotted coat). Both are homozygous alleles, and when crossbred, there's a 100% possibility where Aa (heterozygous dominant allele) is the genotype. This will form spotted coat offspring (leopard).

(b) Two of these offspring are allowed to breed with each other. Draw a genetic diagram to show the ratio of leopards to panthers that would be expected. Show genotypes and phenotypes in your diagrams.

Phenotype of P_1	spotted coat		black coat	
Genotype of P_1	AA		aa	
Gametes	A	A	a	a
Genotype of F_1	Aa	Aa	Aa	Aa
Phenotype of F_1	spotted	spotted	spotted	spotted

Genotype ratio 100% heterozygous : 0 % homozygous
Phenotype ratio 4 spotted : 0 panthers