4. TYPICAL EXAM QUESTIONS

QUESTION 1 *(Questions taken from various sources)*

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1 to 1.6) in your ANSWER BOOK, for example 1.7 D.

1.1 In humans, light hair colour is recessive to dark hair colour. In one family, the mother has dark hair, the father has light hair, one daughter has light hair and the other daughter has dark hair.

Which ONE of the following combinations best represents the genotypes for the mother and the daughter with dark hair?

A mother DD, daughter DD
B mother Dd, daughter Dd
C mother DD, daughter Dd
D mother Dd, daughter DD

1.2 Ultraviolet radiation causes mutations, which sometimes leads to antibiotic resistance in bacteria. To investigate this, bacteria were first exposed to ultraviolet radiation and then their resistance to different antibiotics was measured. The results are shown in the table below.

✓ = resistant **X = non-resistant**

Treatment	Antibiotic resistance		
	Antibiotic P	**Antibiotic R**	**Antibiotic S**
Before exposure to ultraviolet radiation	✓	X	X
After exposure to ultraviolet radiation	✓	X	✓

A suitable conclusion for the investigation would be that a mutation in bacteria led to a resistance to antibiotic …

A R only.
B P and R.
C S only.
D R and S.

1.3 In the tobacco plant, albinism (the inability to make chlorophyll) is a recessive trait. Two heterozygous tobacco plants were crossed, and 300 seedlings were produced. What is the percentage chance that the seedlings will have albinism?

A 75%

B 300%

C 50%

D 25%

1.4 An autosomal genetic disorder is caused by a dominant allele **R**.

Consider the following crosses.

(i) rr x Rr

(ii) rr x RR

(iii) Rr x Rr

(iv) Rr x RR

Which ONE of the following combinations of crosses can result in offspring without the disorder?

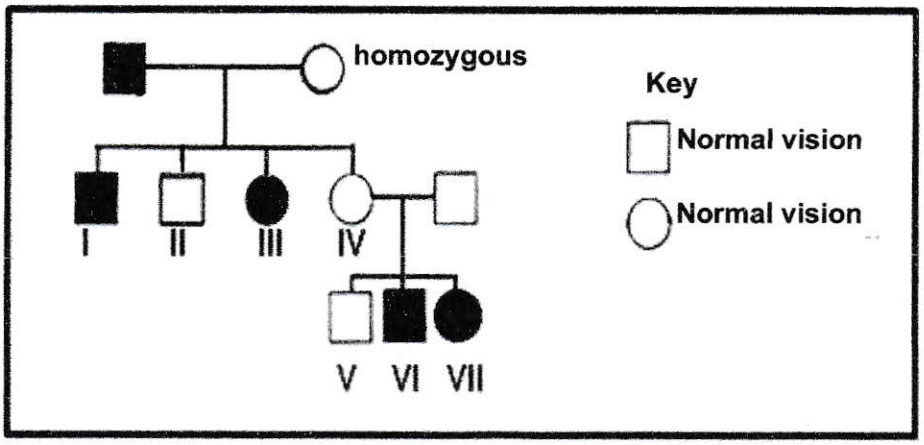
A (i) and (ii) only

B (i) and (iii) only

C (i) only

D (ii) and (iv) only

1.5 Study the pedigree diagram below which shows the inheritance of colour-blindness caused by a recessive allele in humans.



Which offspring show the INCORRECT representation of the inherited trait?

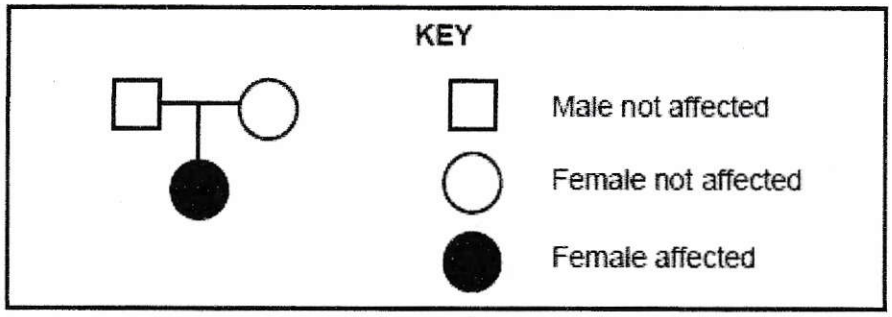
A I, II and III

B I, IV and V

C I, III and VII

D I, II, III, VI and VII

1.6 The diagram below shows the pattern of inheritance of a disorder



One can conclude that the disorder is caused by a ...

A recessive allele, with both parents heterozygous.

B dominant allele, with both parents heterozygous.

C recessive allele, with one parent homozygous recessive while the other is heterozygous.

D dominant allele, with one parent heterozygous while the other is homozygous recessive.

(6 x 2) **(12)**

QUESTION 2 *(Questions taken from various sources)*

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (2.1 to 2.5) in your ANSWER BOOK.

2.1 The type of inheritance where two different alleles of a gene are expressed in the phenotype

2.2 A genetic cross involving only one characteristic

2.3 The position of a gene on a chromosome

2.4 A sex-linked disorder that affects the photoreceptors in the eye

2.5 More than two alleles for the same gene **(5)**

QUESTION 3 *(Questions taken from various sources)*

Indicate whether each of the statements in COLUMN I applies to **A ONLY, B ONLY, BOTH A AND B or NONE** of the items in COLUMN II. Write **A only, B only, both A and B,** or **none** next to the question number (3.1 and 3.2) in the ANSWER BOOK.

	COLUMN I	COLUMN II
3.1	**Cause of Down syndrome**	**A: Gene mutation** **B: Extra copy of chromosome number 23**
3.2	**An allele for one gene could appear in the same gamete with any of the alleles of another gene**	**A: Dihybrid cross** **B: Mendel's law of independent assortment**

(2 x 2) **(4)**

QUESTION 4 *(DBE, Nov 2017 Paper 2)*

Mendel observed some characteristics of the pea plant *(Pisum sativum)* which he suggested were controlled by inherited factors. He conducted a series of experiments in which he crossed pea plants with contrasting phenotypes to obtain the offspring of the F_1 generation. At first his crosses were simple and involved only one pair of characteristics.

Mendel counted the number of offspring showing each of the variations.

His results are shown in the table below.

PLANT PART	CHARACTERISTIC	P_1 GENERATION	F_1 GENERATION
Seed	Seed texture	Round x wrinkled	All round
	Seed colour	Yellow x green	All yellow
Pod	Pod texture	Full x constricted	All full
	Pod colour	Green x yellow	All green
Flowers	Flower colour	Violet x white	All violet
Stem	Location of flower of the stem	Axial x terminal	All axial
	Height of stem	Tall x short	All tall

4.1 Give the term for:

(a) The *inherited factors* that Mendel referred to (1)

(b) A cross involving only ONE characteristic (1)

4.2 Name the female structure of the flower where meiosis occurs. (1)

4.3 Use the information in the table above to give the NUMBER of EACH of the following:

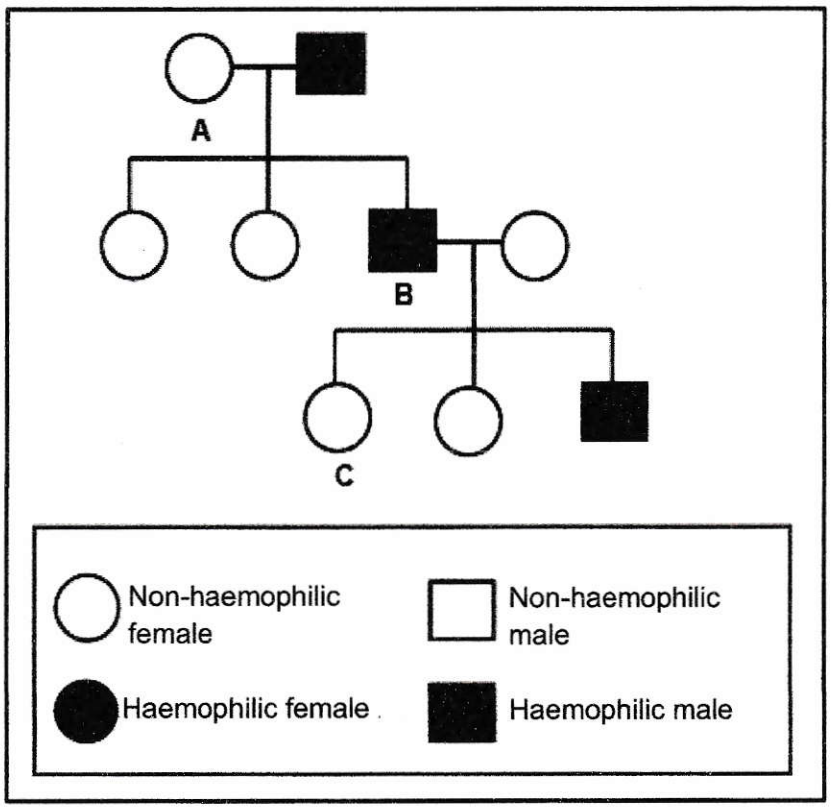
(a) Characteristics of pods (1)

(b) Alleles for seed characteristics (1)

QUESTION 7 (*DBE, May-June 2017 Paper 2*)

Haemophilia is a genetic disorder resulting in the abnormal clotting of blood. It is caused by a recessive allele that is carried on the **X**-chromosome. The allele for normal clotting is $\mathbf{X^H}$ and the allele for haemophilia is $\mathbf{X^h}$.

The inheritance of haemophilia in a family is shown in the diagram below.



7.1 Give the percentage of the males with haemophilia in this family. (1)

7.2 Give the phenotype for individual **A**. (1)

7.3 Give the genotype for individual:

(a) B (1)

(b) C (2)

(5)

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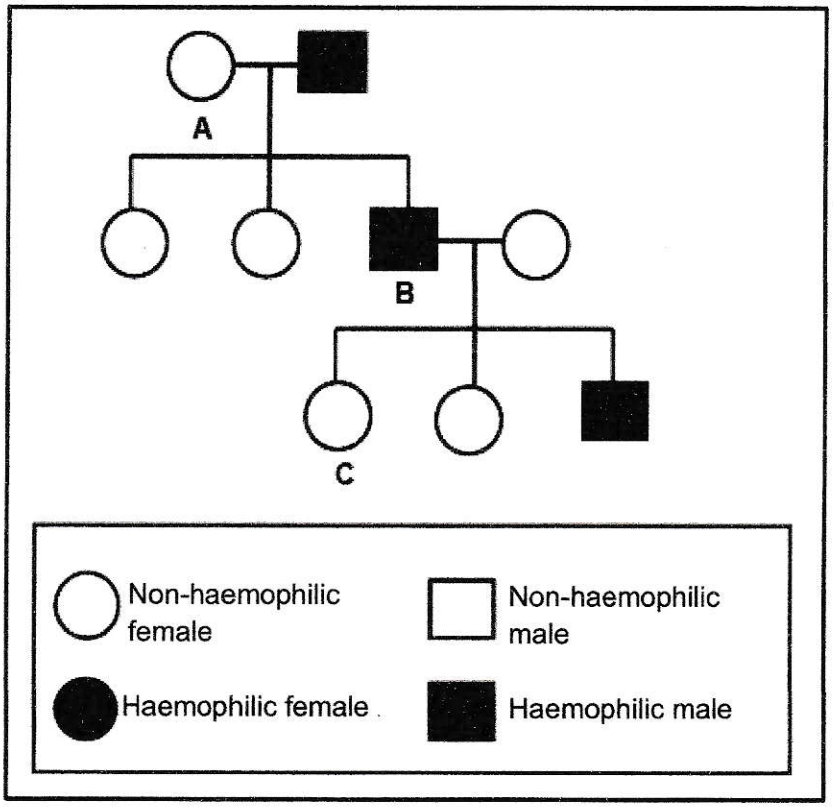


7.1 Give the percentage of the males with haemophilia in this family. (1)

7.2 Give the phenotype for individual **A**. (1)

7.3 Give the genotype for individual:

(a) B (1)

(b) C (2)

(5)

QUESTION 3

3.1 B only ✓✓

3.2 Both A and B ✓✓ (2 X 2) **(4)**

QUESTION 4

4.1 The process by which the DNA of a person/organism is analysed✓ to obtain a barcode pattern✓ (2)

4.2
- All the bars/bands of a baby must match the bars of the parents✓
- 3 of the bars/bands of baby 2 does not match✓
- any bars of Mr and Mrs Taylor✓

(3)

4.3
- Mark the samples clearly✓ to make sure vials are not swopped.✓
- Wear gloves and a mask✓ not to contaminate samples with your own DNA✓
- Use new and clean/sterilised apparatus✓ not to contaminate samples.✓

(Mark first ONE only) **(Any 1 x 2)** (2)

(7)

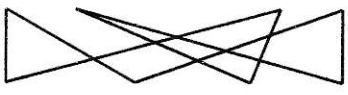
QUESTION 5

5.1 **P_1**/parent phenotype: tortoise-shell female x orange male✓

genotype: X^BX^O x X^OY ✓

Meiosis

G/gametes X^B , X^O x X^O, Y ✓



Fertilisation

F_1/offspring genotype X^BX^O, X^BY, X^OX^O, X^O Y ✓

phenotype 1 tortoise-shell female, 1 black male, 1 orange female and 1 orange male✓*

(*1 mark for gender and fur colour with correct proportion)

P_1 and F_1✓

Meiosis and fertilisation✓ *Compulsory 1 + any 6

OR

P_1/parent phenotype tortoise-shell female x orange male✓

genotype X^BX^O x X^OY ✓

Meiosis

Fertilisation

gametes	X^B	X^O
X^O	X^BX^O	X^OX^O
Y	X^BY	X^O Y

1 mark for correct gametes
1 mark for correct genotypes (7)

F_1/offspring phenotype: 1 tortoise-shell female, 1 black male,
1 orange female and 1 orange male✓*

(*1 mark for gender and fur colour with correct proportion)

P_1 and F_1✓

Meiosis and fertilisation✓ *Compulsory 1 + any 6

5.2
- The allele for the fur colour is carried on the X-chromosome✓
- Male have only one X-chromosome✓
- Tortoise shell is only expressed in the heterozygous condition/X^BX^O✓

OR

- If the male is X^BY it is black✓
- if the male is X^OY it is orange✓
- and therefore, can never be tortoise shell as males have one X chromosome only.✓ (3)

(10)

QUESTION 6

6.1 Purple flowers, long pollen grains ✓ (1)

6.2 ab ✓✓ (2)

6.3 Purple flowers, long pollen grains ✓: purple flowers, round pollen grains ✓ (2)

(5)