



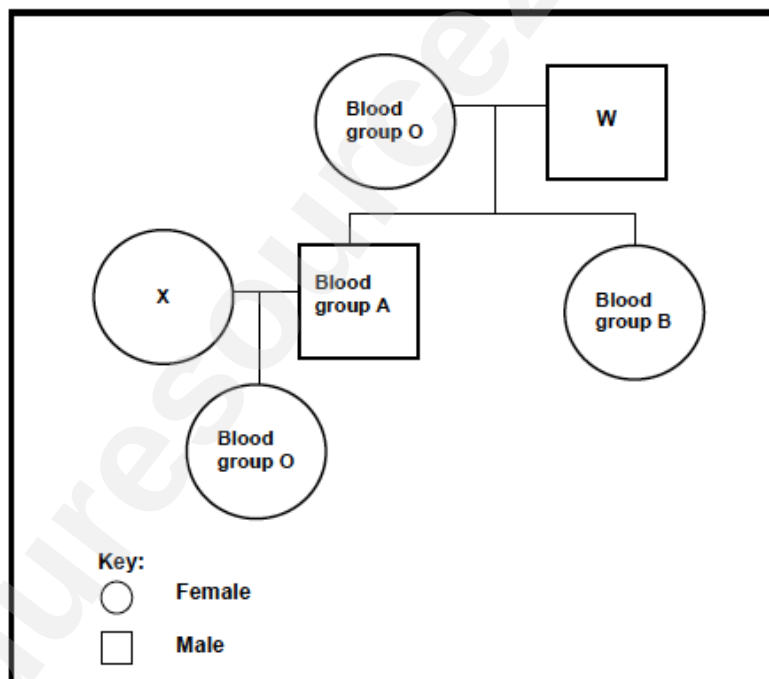
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CONSOLIDATION EXERCISE A – GENETICS

Learner Note: You MUST adhere to the time allocations for each question. This is a very important examination skill. The time allocation is based on the number of marks allocated to the question. Do NOT waste time. If you do not know the answer immediately, then write down the question number in your answer book and leave a few lines blank so that you are able to go back and answer it later. If you waste time on an answer that you do not know, you will not manage to complete the examinations at the end of the year.

SECTION A: TYPICAL EXAM QUESTIONS**Question 1: 11 minutes***(Taken from DoE November 2009 Paper 1)*

It is possible to trace the inheritance of characteristics such as blood groups and genetic disorders over a number of generations.



1.1 The pedigree diagram below shows the blood groups of individuals of a family. The blood groups are indicated inside the circle or square. The blood groups of individuals W and X are not indicated. Write down all the possible genotypes of individuals:

(a) W

(b) X

(8)

1.2 Haemophilia is a blood clotting disorder. Explain why mainly males suffer from this disorder.

(4)

Question 2: 7 minutes

(Taken from DoE Additional Exemplar 2008)

The table below shows the chromosome complement of human egg and sperm cells.

EGG (23)	SPERM (23)	ZYGOTE (46)	SEX OF CHILD
22 + X	22 + X	(a)	(c)
22 + X	22 + Y	(b)	(d)

2.1. Write down the letters (a) and (b) and next to each letter the chromosome complement that completes the table above.

(2)

2.2. Write down the letters (c) and (d) and next to each letter the sex of the child that completes the table above.

(2)

2.3. A woman has three children, all of whom are boys. What is the probability of her fourth child being a girl? Explain your answer.

(3)

Question 3: 22 minutes

(Taken from DoE Exemplar 2008 Paper 1)

Read the passage below and then answer the questions based on it.

Sixty-five million affected by HIV

A new United Nations report revealed that since the first cases of HIV and Aids were detected 25 years ago, sixty-five million people around the world have become infected with HIV and around 25 million have died.

The distribution of the number of people living with HIV in various parts of the world at the end of 2005 is indicated in the table below.

Region	Number living with HIV (million)
Sub-Saharan Africa	25,00
Asia	8,30
Eastern Europe and Central Asia	1,50
Latin America	1,60
Middle East	0,44
Other countries	1,76
Total	38,60

[Adapted from: Evelyn Leopold for Reuters in the Daily News, 31 May 2006]

- 3.1. State TWO reasons why the figures reported in this passage may not be accurate. (2)
- 3.2. Using the information in the passage above calculate the percentage of HIV infected people in each region. (3)
- 3.3. Use the percentages calculated in QUESTION 3.2 to draw a pie chart of HIV infected people in each region. (11)
- 3.4. Although the population of Africa is much lower than that of Asia, the 25 million people living with HIV in Africa is about three times the number of people living with HIV in Asia. Give TWO possible reasons for this. (4)
- 3.5. The following proposal was made to control the spread of HIV:
'An HIV test should be compulsory before people get married.'
Explain your view on this. (2)

SECTION B: SOLUTIONS AND HINTS

Question 1:

1.1

(a) $I^A I^B$ ✓✓

AB ✓✓

(2)

(Mark first ONE only)

(b) $I^A I^A$ ✓✓ or $I^A I^O$, $I^B I^B$ ✓✓ or $I^B I^O$, or $I^O I^O$ ✓✓

AO ✓✓ BO ✓✓ OO ✓✓

(6)

(Mark first THREE only)

- 1.2 It is a sex-linked ✓ disease
caused by a recessive allele ✓
carried on the X ✓ chromosome
Males need only one recessive allele ✓ to have the disease because they have the XY combination, while females have to have both recessive alleles ✓ to have haemophilia because they have the XX combination (4)

(Mark any four of the above)

Question 2:

- 2.1 (a) 44XX ✓
(b) 44XY ✓ (2)
- 2.2 (c) girl ✓
(d) boy ✓ (2)
- 2.3 50% ✓ / equal chance that the fourth child would be a boy or a girl
Half of all the sperm of the father carries the X chromosome ✓
and half of all the sperm carries the Y chromosome ✓ (3)

Question 3:

- 3.1 Many cases are not officially recorded ✓
 Many people don't know yet whether they are HIV positive ✓
 Figures often represent testing of a sample of people and cannot necessarily be projected to the whole of a country's population ✓

(2)

(Mark any TWO)

(Please note: the reason must be logical. This answer is based on common sense and you are expected to be able to apply logic and reason to facts that are given to you.)

3.2 Calculations

Rubric for the mark allocation of the calculations

Marks	Calculations
1	1 - 2 correct
2	3 - 4 correct
3	5 - 6 correct

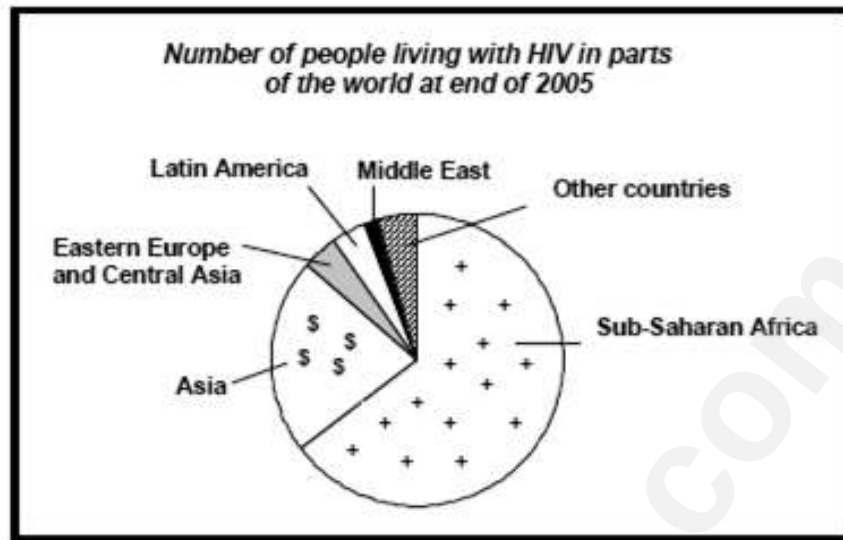
1. Sub-Saharan Africa: $25/38,6 \times 100 = 64,77\%$
2. Asia: $8,3/38,6 \times 100 = 21,50\%$
3. Eastern Europe and Central Asia: $1,5/38,6 \times 100 = 3,87\%$
4. Latin America: $1,6/38,6 \times 100 = 4,15\%$
5. Middle East: $0,44/38,6 \times 100 = 1,14\%$
6. Other countries: $1,76/38,6 \times 100 = 4,56\%$

(You must be able to do basic calculations. Always make sure that you take a calculator into the Life Sciences exams with you. You must be able to calculate percentage.)

3.3.

Rubric for the mark allocation of the graph

Correct type of graph	1
Correct proportions	1: 1 - 2 correct 2: 3 - 4 correct 3: 5 - 6 correct
Label / key for each slice	6 x 1 = 6
Title	1



NOTE: If the wrong type of graph is drawn: marks will be lost for "correct type of graph" as well as for drawing the slices in correct proportions: (11)

Pie Charts: A reminder about Pie Charts and calculations.

- Pie charts illustrate the **proportions** of an identifiable whole. The **data** is a proportion of the **total**, represented as a circle = **total of proportions or 100%**.
- The circle is divided into **sectors** (like the pieces of a pie). Each sector represents a **percentage** of the total and shows the **relative portion** of each of the parts.
- Pie charts are normally arranged in a **clockwise** direction, from smallest sector to the largest sector, starting at 12 o'clock. The angles of each sector can be determined using the following formula:

$$D = \frac{V \times 360}{T}$$

Where:

D = the angle of the sector in degrees

V = the actual amount of the variable

T = the grand total (100%)

If you have to find the angle of the sector for 35%:

$$\frac{35}{100} \times 360^\circ = \frac{12\,600}{100} = 126^\circ$$

If you have to determine the percentage represented by 94° :

$$\frac{94^\circ}{360^\circ} = 0.26 \times 100 = 26\%$$

- 3.4 Greater level of poverty✓ and lack of knowledge of the disease in Africa✓
 Women have little power✓ over sexual relations in Africa✓/
 Any other logical suggestion

(4)

(Mark first TWO only)

- 3.5 Partners need to know their HIV status ✓ so that they can be protected if necessary ✓
OR
 This can cause a lot of distrust ✓ between partners ✓
OR
 HIV testing ✓ has costs implications ✓
OR
Any other logical answer (2)

SECTION E: SOLUTIONS TO SESSION 18 HOMEWORK
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1. The gene for sex-linked disorders is found on a sex chromosome (XX or XY), ✓ e.g.: haemophilia. ✓
 The gene for an autosomal genetic disorder is located on any of the other 23 chromosome pairs, ✓ e.g.: muscular dystrophy, albinism, Huntington's chorea etc. ✓ (4)
2. The learner will either state that they decide to terminate or have the child. ✓
 There is no correct answer and must be based on the learner's personal, cultural and religious views. It is important that both aspects are not discussed. Should this be the case – only the first decision is marked. The learner must validate their answer with logical, acceptable reasons. ✓✓✓ (4)
- 3.1 Sickle cell anaemia ✓ (1)
- 3.2 $100\% - (78+7+10)\% = 5\%$ ✓

$$\frac{5}{100} \times \frac{1200}{1} \checkmark$$
 60 ✓ people (3)
- 3.3 - Parents can decide whether to abort foetus or not ✓
 - Help prepare parents to manage with such a child ✓ (1)

(Mark first ONE only)