1. Amniocentesis and chorionic villus sampling are two techniques that can be used to detect chromosomal mutations in a fetus.

Which of the following statements is / are true?

Statement 1: amniocentesis can be performed earlier in pregnancy than chorionic villus sampling.
Statement 2: amniocentesis carries a lower risk of miscarriage than chorionic villus sampling.
Statement 3: amniocentesis carries a lower risk of fetal deformities than chorionic villus sampling.

A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer ☐

[1]

2. Most bananas available in shops are triploid.

Which stage of the cell cycle would banana plants be unable to complete?

A cytokinesis
B mitosis
C meiosis
D S phase

Your answer ☐

[1]

3. Fig. 14.1 shows a karyotype produced from human cells collected at week 12 of a pregnancy.

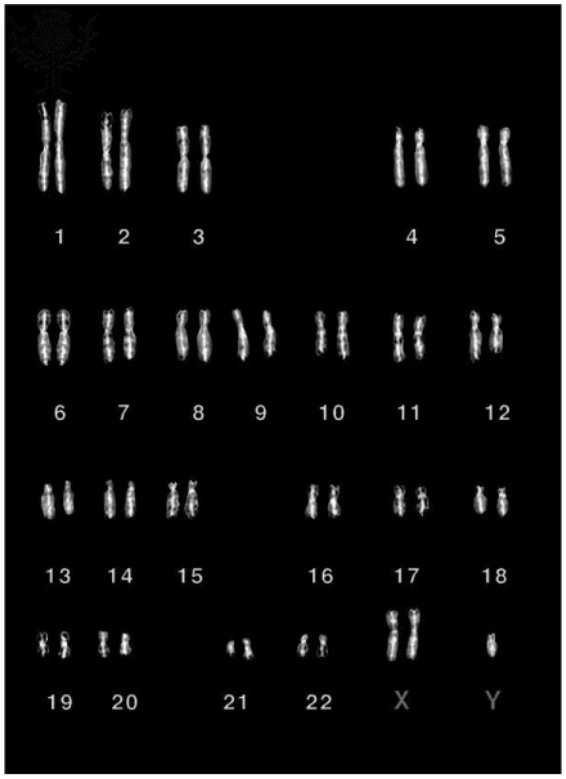


Fig. 14.1

Which of the following statements describes the safest, most effective way to collect **and** treat the cells at week 12?

A Collected by chorionic villus sampling. Colchicine added to stimulate mitosis.
B Collected by chorionic villus sampling. Colchicine added to halt mitosis.
C Collected by amniocentesis. Colchicine added to stimulate mitosis.
D Collected by amniocentesis. Colchicine added to halt mitosis.

Your answer ☐

[1]

4. Fig. 14.1 shows a karyotype produced from human cells collected at week 12 of a pregnancy.

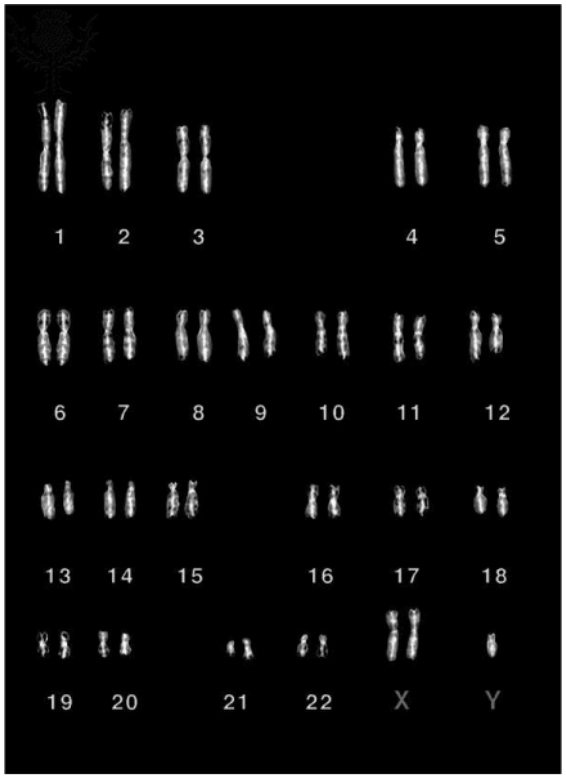


Fig. 14.1

Which of the following correctly identifies the condition shown by the karyotype in Fig. 14.1?

A a normal female
B a female with Klinefelter's syndrome
C a male with Klinefelter's syndrome
D a male with Turner's syndrome

Your answer ☐

[1]

5. Women in the UK are advised to increase their intake of certain nutrients during pregnancy to meet the additional demands of the developing fetus.

Which of the following is correct?

A Folic acid intake should increase as it is needed for DNA synthesis.
B Folic acid intake should increase as it is needed for collagen synthesis.
C Iron intake should increase as it is needed for haemoglobin synthesis.
D Iron intake should decrease as it is not needed for haemoglobin synthesis.

Your answer ☐

[1]

6. Karyotypes, as shown below in **Fig. 8.1**, can be used to diagnose chromosome abnormalities.

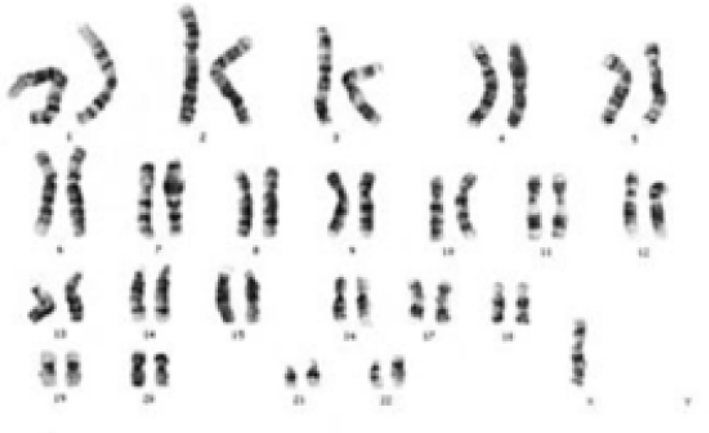


Fig. 8.1

The karyotype above shows someone diagnosed with which genetic condition?

A male with Down's syndrome
B female with Down's syndrome
C Turner's syndrome
D Klinefelter's syndrome

Your answer ☐

[1]

7. **Fig. 29.1** is a diagram of a section through the flower of the bean plant, *Vicia fabia*.

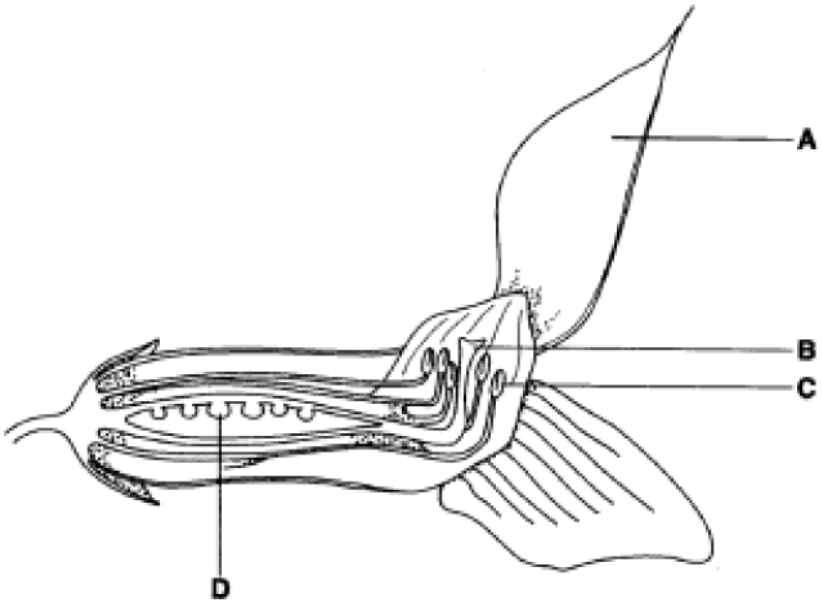


Fig. 29.1

Which of the letters on the diagram indicate sites where meiosis occurs?

A A and B
B B and C
C B and D
D C and D

Your answer ☐

[1]

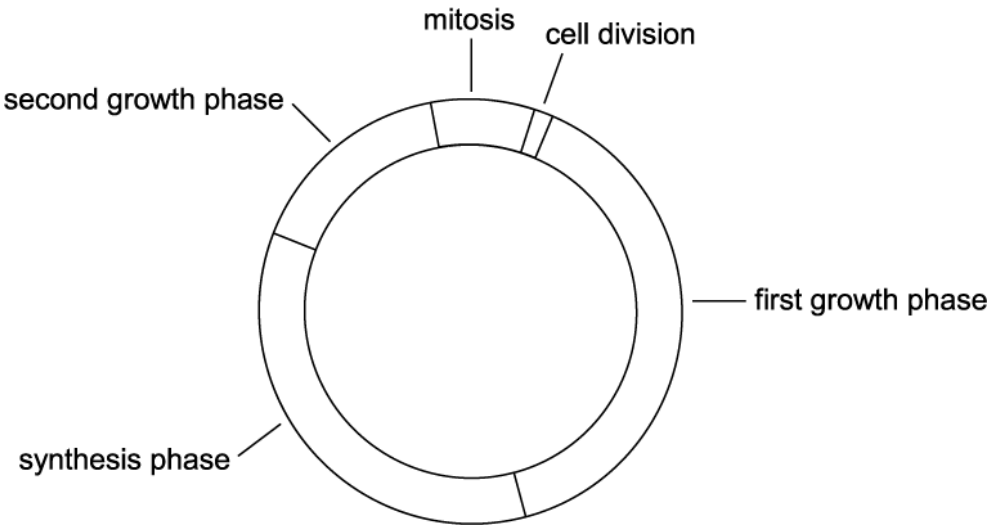
8. Which of the options, **A** to **D**, is a meiotic process that does **not** give rise to genetic variation?

A crossing over of non-sister chromatids
B crossing over of sister chromatids
C independent assortment of chromatids
D independent assortment of chromosomes

Your answer ☐

[1]

9. The diagram below represents the cell cycle in eukaryotes.



Which of the options, **A** to **D**, is the phase in which spontaneous mutations are most likely to arise?

A mitosis
B first growth phase
C synthesis phase
D second growth phase

Your answer ☐

[1]

10. In human fertilisation, a spermatozoon penetrates an ovum and forms a diploid cell known as a zygote.

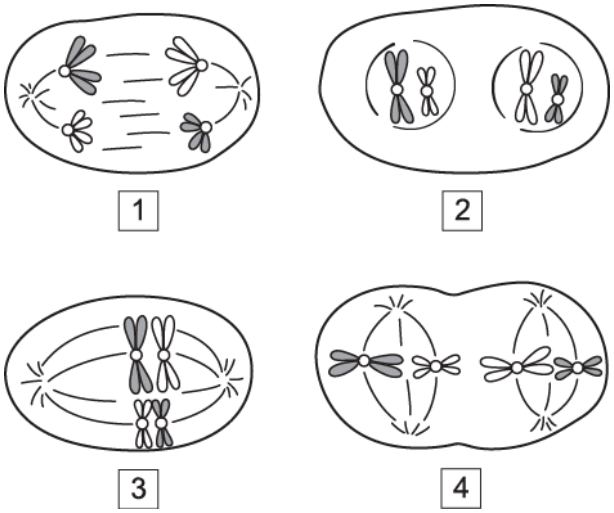
Which of the options, **A** to **D**, correctly describes the zygote?

A multipotent
B pluripotent
C totipotent
D unipotent

Your answer ☐

[1]

11. The diagram shows four different stages in meiosis.



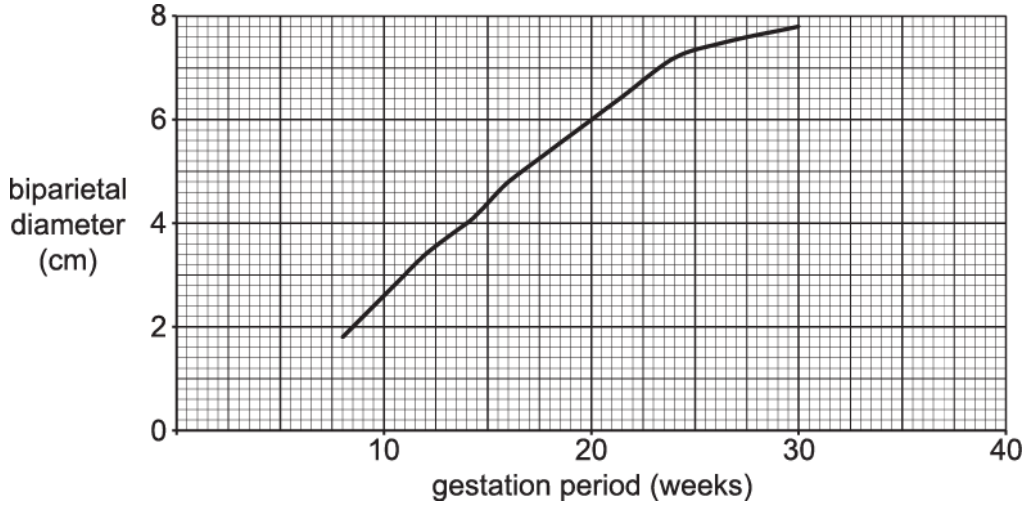
Which of the options, **A** to **D**, shows the correct sequence in which these four stages would occur?

A 3, 1, 4, 2
B 3, 2, 4, 1
C 3, 1, 2, 4
D 4, 1, 2, 3

Your answer ☐

[1]

12. The chart shows biparietal diameter measurements for a fetus during its development.



Which of the options, **A** to **D**, shows the correct percentage increase in biparietal diameter between 12 and 22 weeks of gestation?

A 48%
B 113%
C 94%
D 51%

Your answer

[1]

13. Klinefelter's syndrome can be diagnosed by looking at the arrangement of chromosomes in a karyotype.

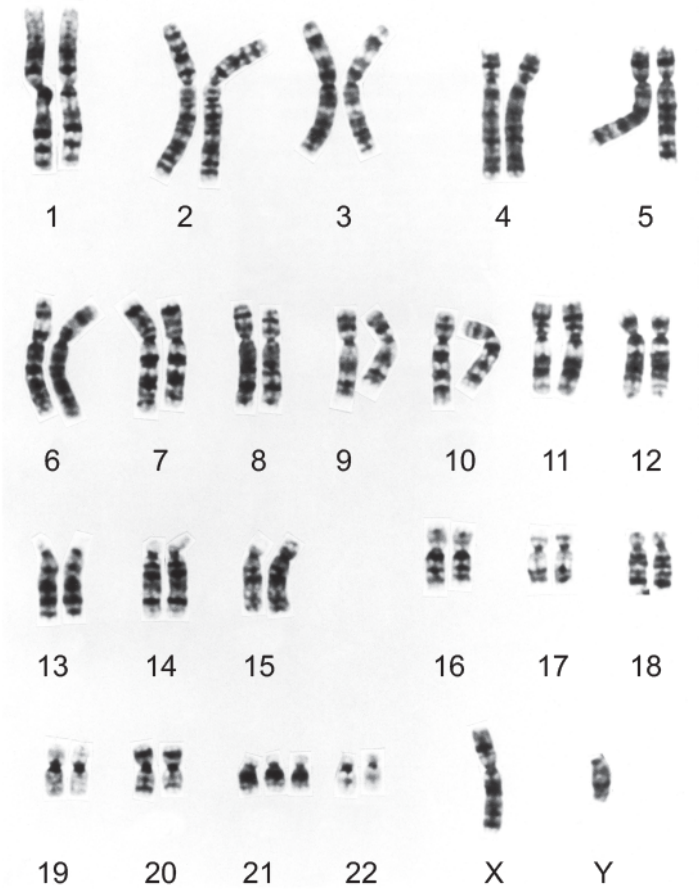
Which of the options, **A** to **D**, shows the sex chromosomes present in the karyotype of someone with Klinefelter's syndrome?

A X only
B XYY
C XXX
D XXY

Your answer

[1]

14. A karyotype of a person with a genetic disorder is shown below.



Which of the options, **A** to **D**, correctly identifies the genetic disorder shown in the karyotype?

A Down's syndrome
B Klinefelter's syndrome
C Nail-patella syndrome
D Turner's syndrome

Your answer [ ] **[1]**

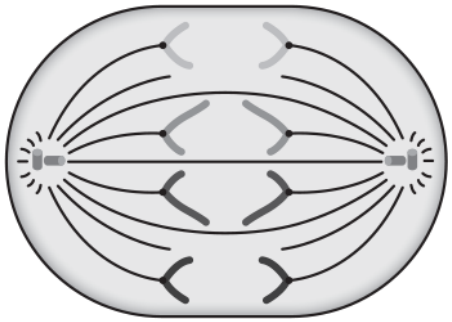
15. In spermatogenesis, crossing over of the chromatids of homologous chromosomes gives rise to genetic variation.

Which of the options, **A** to **D**, is the cell type in which crossing over occurs?

A primary spermatocyte
B secondary spermatocyte
C spermatogonium
D spermatid

Your answer [ ] [1]

16. The diagram below shows a cell during cell division. The diploid number of this cell is four.



Which of the options, **A** to **D**, is correct?

A the cell is in telophase 1 of meiosis
B the cell is in telophase of mitosis
C the cell is in anaphase of mitosis
D the cell is in anaphase 1 of meiosis

Your answer ☐ **[1]**

17. Chromosome mutations can cause syndromes such as Down's syndrome.

Which of the options, **A** to **D**, is the correct chromosome content in the cells of a male with Down's syndrome?

A 47 chromosomes, XXY
B 47 chromosomes, XY
C 45 chromosomes, OY
D 45 chromosomes, XY

Your answer ☐ **[1]**

18. The number of chromosomes in a developing fetus can be checked by producing a karyogram.

Which of the options, **A** to **D**, about the production of a karyogram is **not** correct?

A fetal cells can be extracted from the placenta

B fetal cells are stimulated to divide by meiosis

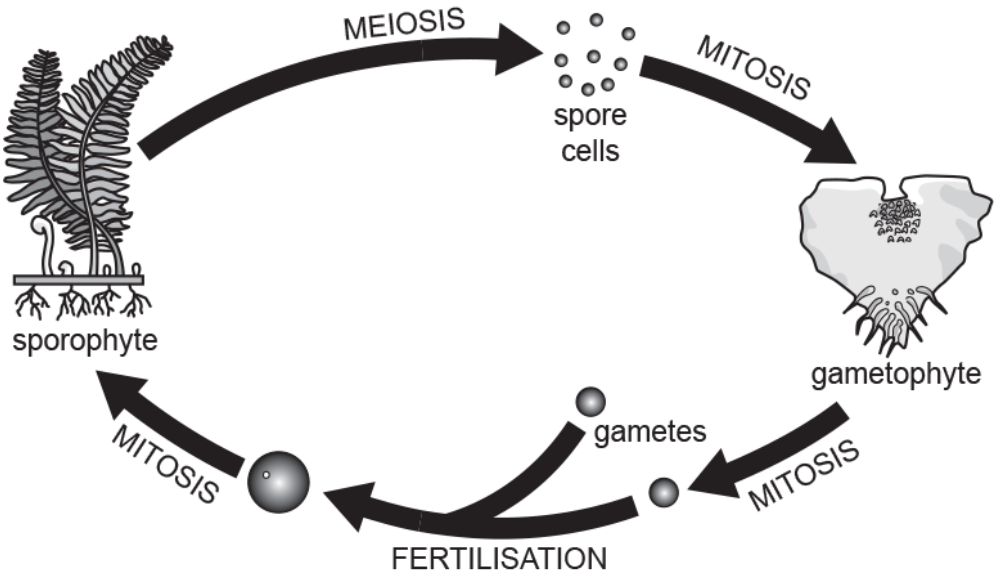
C a chemical is added to stop cell division in metaphase

D the chromosomes are stained and photographed

Your answer ☐ **[1]**

19. Plant life cycles show alternation of generations. The term alternation of generations is used to describe a process whereby mitosis and meiosis occur and the plant alternates between haploid and diploid forms during its life cycle.

Alternation of generations in the life cycle of a fern (*Polypodium* species) is shown in the diagram below.



Which of the rows, **A** to **D**, is correct?

	Sporophyte	Gametophyte	Spore cell	Gamete
A	diploid	haploid	haploid	haploid
B	haploid	diploid	haploid	haploid
C	diploid	haploid	diploid	diploid
D	diploid	diploid	haploid	haploid

Your answer ☐ **[1]**

20. During her first antenatal appointment, a woman was advised that she needed to increase her current Dietary Reference Value (DRV) energy intake from 7800 KJ to 9200 KJ.

Which of the options, **A** to **D**, shows the correctly calculated percentage increase in DRV energy intake?

A 85%

B 118%

C 15%

D 18%

Your answer ☐ **[1]**

21. Meiosis II pauses in the secondary oocyte and is only completed if fertilisation occurs.

Which of the options, **A** to **D**, is a description of the **last** meiotic stage prior to fertilisation?

A Homologous chromosomes align to the equator of the oocyte.

B Homologous chromosomes migrate to opposite poles of the oocyte.

C Single chromosomes align to the equator of the oocyte.

D Sister chromatids migrate to opposite poles of the oocyte.

Your answer [ ] **[1]**

22. Which of the options, **A** to **D**, is a molecule that requires vitamin C for its synthesis?

A collagen

B deoxyribonucleic acid

C haemoglobin

D rhodopsin

Your answer [ ] **[1]**

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1			C	1	
			Total	**1**	
2			C	1	
			Total	**1**	
3			B	1	
			Total	**1**	
4			C	1	
			Total	**1**	
5			A	1	
			Total	**1**	
6			C	1	
			Total	**1**	
7			D	1	
			Total	**1**	
8			B	1	
			Total	**1**	
9			C	1	
			Total	**1**	
10			C	1	
			Total	**1**	
11			C	1	**Examiner's Comments** This should have been fairly straightforward for candidates who could recall the stages of meiosis and put them in the correct order. However, many candidates incorrectly suggested option **A**, possibly as they had failed to notice that three of the diagrams showed meiosis I whilst diagram 4 was demonstrating meiosis II so needed to be last in the order.

Question			Answer/Indicative content	Marks	Guidance
			Total	1	
12			C	1	Examiner's Comments This question highlighted the challenges that many candidates have with percentage increase calculations. Provided they read the correct data from the graph and used the correct mathematical formula the response should have been straightforward.
			Total	1	
13			D	1	Examiner's Comments A straightforward recall question completed this section, although some candidates confused Klinefelter's with Turner's syndrome.
			Total	1	
14			A ✓	1	Examiner's Comments This question was straightforward recall and the majority of candidates chose the correct response.
			Total	1	
15			A ✓	1	Examiner's Comments Another straightforward question but a disappointing number of candidates answered correctly.
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
16			C	1	Examiner's Comments In this question candidates had to process both textual and diagrammatic information about cell / nuclear division. Candidates who noticed and understood the reference to the diploid number of the cell being four were then able to apply this knowledge to analysing the diagram and choosing C as the correct option.
			Total	1	
17			B	1	Examiner's Comments This was a straightforward recall question, although some candidates still confuse Down's, Klinefelter's and Turner's syndromes.
			Total	1	
18			B	1	Examiner's Comments Many candidates were able to pick out the incorrect statement here, clearly demonstrating knowledge of cell division and karyograms.
			Total	1	
19			A	1	Examiner's Comments In this question candidates had to process both textual and diagrammatic information about the consequences of mitosis and meiosis in the novel context of plant life cycles. Many candidates who could apply their knowledge to the information provided in the diagram went on to choose A as the correct option.
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
20			D	1	Examiner's Comments Candidates often struggle with such percentage calculations in section B, but this posed little problem for the majority of candidates who were able to perform the calculation and identify D as the correct option.
			Total	1	
21			C	1	Examiner's Comments The level of recall demanded by this question proved problematic for many candidates. Despite the question asking about the completion of meiosis II, many candidates selected option A or B which referred to homologous chromosomes. The question was testing the knowledge that meiosis II is halted at metaphase II prior to fertilisation.
			Total	1	
22			A	1	
			Total	1	