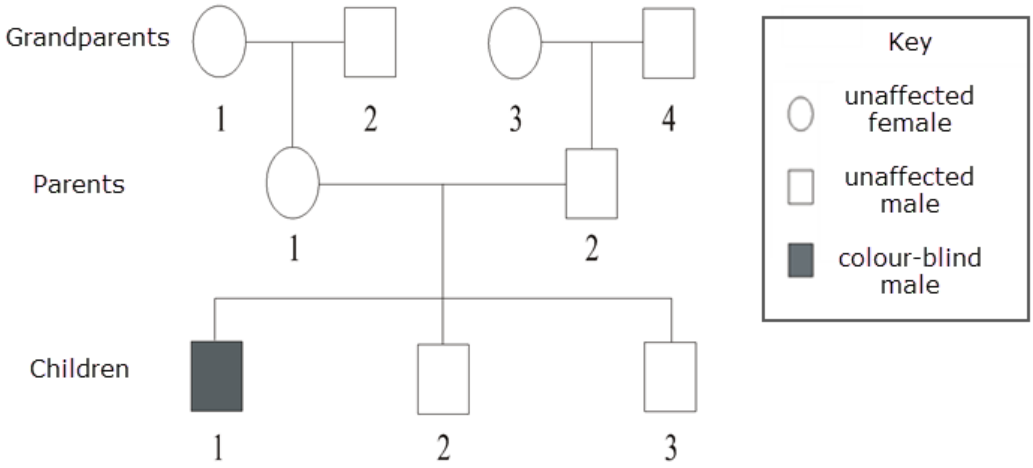
IB Style Test - Topic 3: Genetics

Multiple choice questions

1. Red-green colour blindness is caused by an X-linked recessive allele. In the pedigree chart below which individuals must be carriers of the red-green colour blindness allele?



A. Grandparent 1, parent 1
B. Grandparent 4 and parent 2
C. Parent 1 and parent 2
D. Child 2 and child 3.

2. If the parents in the pedigree chart above had a fourth child who was female, what would be the probability that she was colour blind?

A. 50%
B. 25%
C. 0%
D. None of the above

3. Cystic fibrosis and Huntington's disease are inherited conditions in humans. Which row in the table correctly describes the disease causing allele in each case?

	Cystic fibrosis	Huntington's
A.	Recessive autosomal	Dominant autosomal
B.	Recessive sex-linked	Dominant sex-linked
C.	Dominant autosomal	Recessive autosomal
D.	Dominant sex-linked	Recessive sex-linked

4. Which of the following can cause new alleles to form and may lead to genetic diseases?

    A. Mitosis
    B. Meiosis
    C. Radiation
    D. Variation

5. What are the enzymes used in the process of gene transfer using plasmids in bacteria?

    A. DNA ligase and DNA polymerase
    B. DNA polymerase and Helicase
    C. Restriction endonuclease and DNA ligase
    D. Helicase and Restriction endonuclease.

6. Which of the following best defines the term, “gene”?

    A. a heritable factor that consists of a length of DNA and influences many characteristics.
    B. a heritable factor that consists of a length of mRNA and influences many characteristics.
    C. a heritable factor that consists of a length of DNA and influences a specific characteristic
    D. a heritable factor that consists of a length of mRNA and influences a specific characteristic.

7. What is the main biological use of comparisons of the number of genes between species?

    A. It provides information about the size of the nucleus.
    B. It provides information about how closely related different species are.
    C. It gives information about the amount of DNA a species has.
    D. It gives information about the number of genetic diseases in different species.

8. What is the difference between prokaryote and eukaryote chromosomes?

    A. Prokaryotes have a number of circular DNA molecules while eukaryotes have a single linear DNA molecule.
    B. The prokaryote chromosome is a single circular DNA molecule while eukaryotes have a number of linear DNA molecules.
    C. The prokaryote chromosome is made from plasmid molecules while eukaryotes have a number of linear DNA molecules.
    D. Prokaryotes have a number of circular DNA molecules and eukaryotes have a single linear DNA molecule.

9. The roundworm (*Caenorhabditis elegans*) has a diploid chromosome number of 12. How many chromosomes would be in a haploid roundworm cell?

   A. 24
   B. 12
   C. 6
   D. None of the above.

10. Which two processes are used in DNA profiling?

   A. PCR and gel electrophoresis
   B. Gene transfer and gel electrophoresis
   C. PCR and a Karyogram
   D. Gene transfer and PCR

Structured answer questions

11. A students set up an experiment to clone some plants by growing cuttings of the plants in old drinks bottles. After two weeks the shoot on the left had grown the roots shown in the photo on the right.

Describe how you could use plants like this to investigate the effect of the concentration of a rooting hormone in the water in the bottle on the growth of roots. Include details of the number of plants, the control of variables and how you will measure the growth of the roots.

(6 marks)

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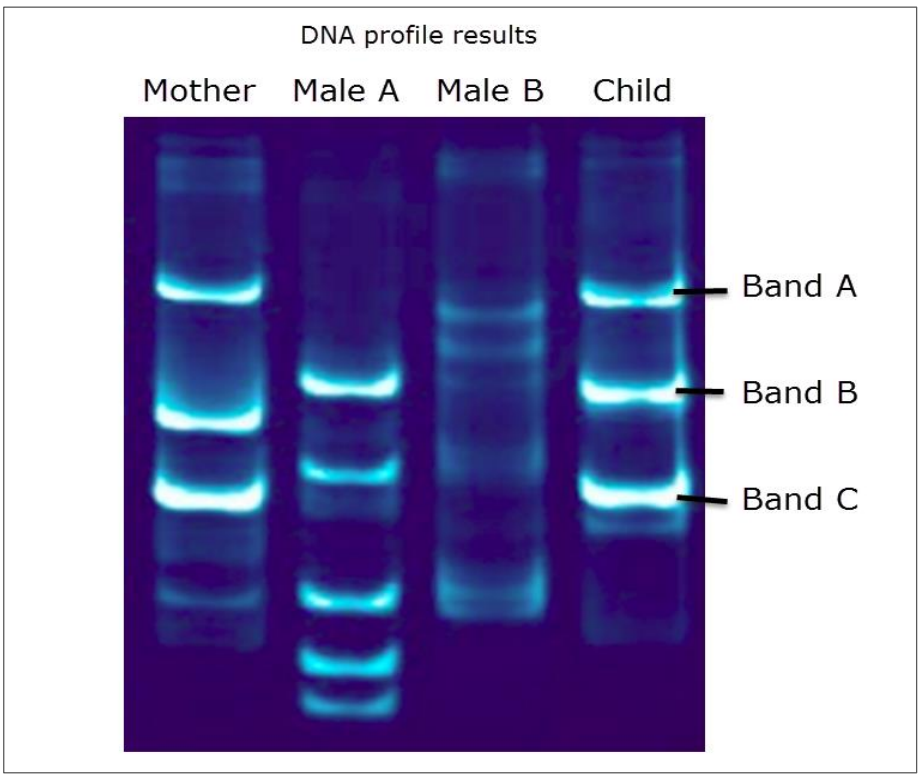
12. DNA profiling is used in paternity investigations. The following diagram shows the results of an investigation of a paternity claim. Both male A and male B claim to be the father of the child.



Analyse the DNA profile and deduce which male is most likely to be the biological father. Explain reasons for your decision.

(2 marks)

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13. State two properties of the DNA fragments in the DNA profile which allow them to be separated by the process of gel electrophoresis

(1 mark)

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14. Some genetic conditions are said to be sex-linked.

a) Define sex linkage

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(1 mark)

b) State one example of a sex linked genetic condition in humans

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(1 mark)

15. In a genetic cross by Gregor Mendel. Pure breeding pea plants with yellow seeds were crossed with pure breeding plants with green seeds. All of the offspring had green seeds.

a) Identify which of the alleles is dominant

(1 mark)

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b) Deduce the genotype of the offspring

(1 mark)

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c) Construct a Punnet grid to show the cross between two offspring plants

(2 marks)

d) Deduce ratio of the different phenotypes for the offspring of this second cross

(1 mark)

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16. Explain one use of the enzyme DNA ligase in biotechnology

(2 marks)

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Extended answer questions

17. Describe the movement of chromosomes in the process of meiosis. Marks will be awarded for correctly labelled diagrams.

(6 marks)

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18. Explain how karyograms can be used to find out information about the genetics of unborn babies.

(6 marks)

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Total 40 marks

Extension Questions

19. Discuss the potential risks and benefits of two named examples of GMO crops?

(6 marks)

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20. Describe the method of cloning using somatic cell nuclear transfer, using the example of Dolly the sheep, or another example.

(6 marks)

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