HWA CHONG INSTITUTION
JC2 Preliminary Examinations
Higher 2

CANDIDATE NAME		**CT GROUP**	**14S ___**
CENTRE NUMBER		**INDEX NUMBER**	

BIOLOGY

9648 / 01

Paper 1 Multiple Choice

17 September 2015

Additional Materials: Optical Mark Sheet

1 hour 15 minutes

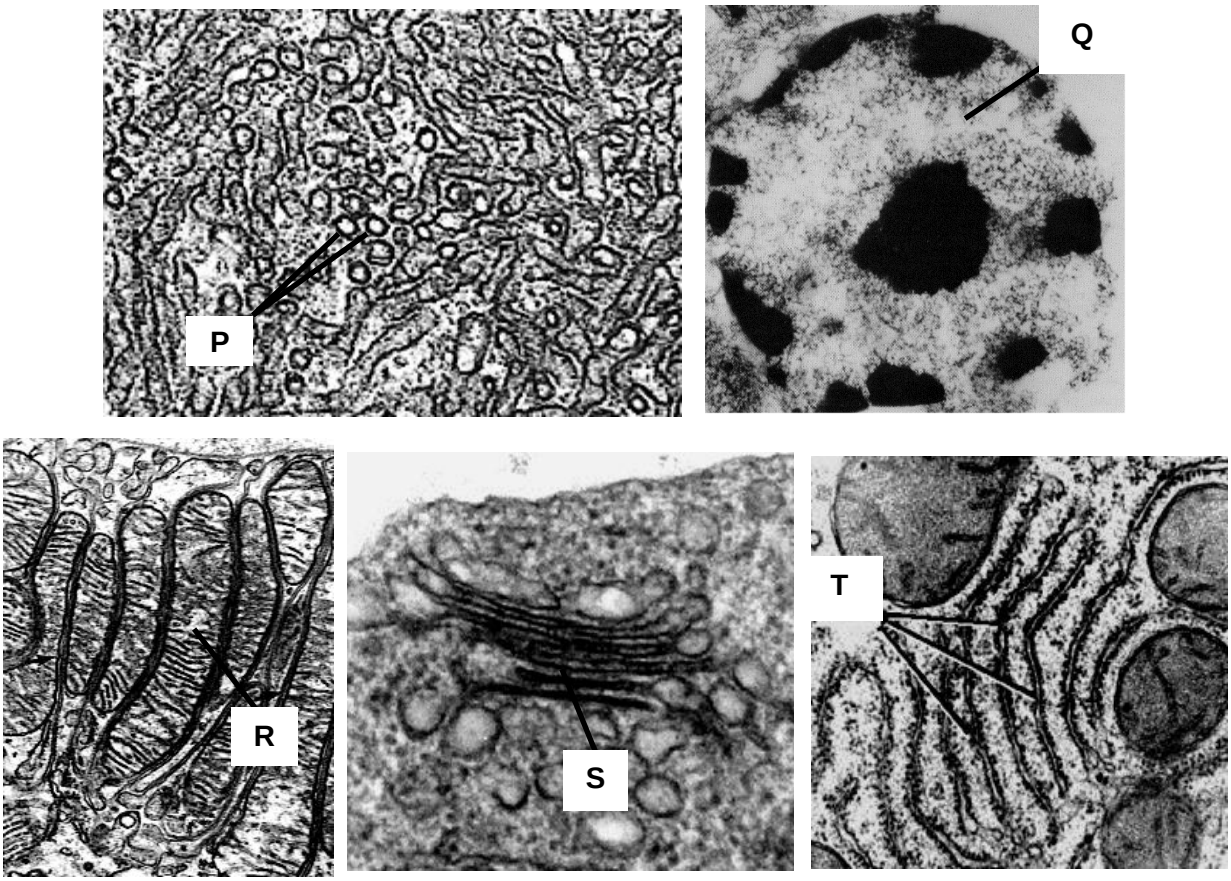
INSTRUCTIONS TO CANDIDATES

1. Write your **name**, **CT group**, **Centre number** and **index number** in the spaces provided at the top of this cover page.
2. Fill in your particulars on the Optical Mark Sheet. Write your **NRIC number** and shade accordingly.
3. There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**.
   Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Optical Mark Sheet.
4. At the end of the paper, you are to submit **only** the Optical Mark Sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

1 The following electron micrographs show various organelles **P** to **T** present in a liver cell.



Radioactive amino acids are supplied to the liver cell to synthesise insulin receptors.

Which sequence shows the correct order in which these amino acids would be detected in the organelles during the synthesis of insulin receptors?

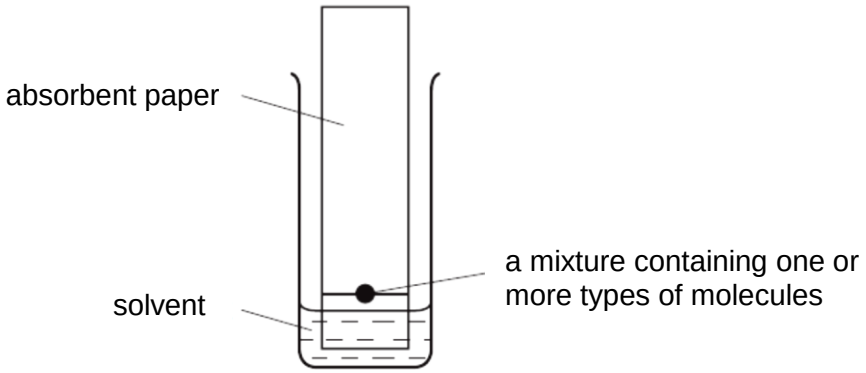
A **Q → T → R → P → S**

B **Q → T → P → S**

C **T → P → S → R**

D **T → S → P**

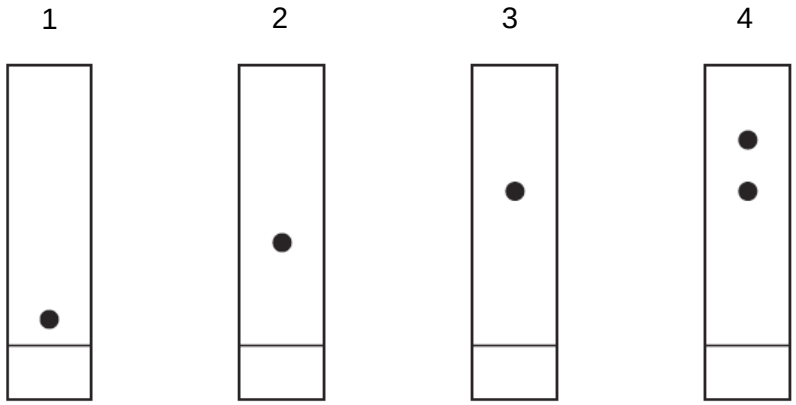
2 Chromatography is a technique used to separate molecules by their solubility. The diagram shows an apparatus used for this technique.



As the solvent rises up the paper, the molecules with the greatest solubility in the solvent travel the greatest distances up the paper. When the solvent reaches the top of the paper, the paper is removed, dried and sprayed with a dye. The different molecules appear as coloured spots.

Chromatography was carried out on four different samples – sucrose, cellulose as well as the products of complete hydrolysis of sucrose and cellulose.

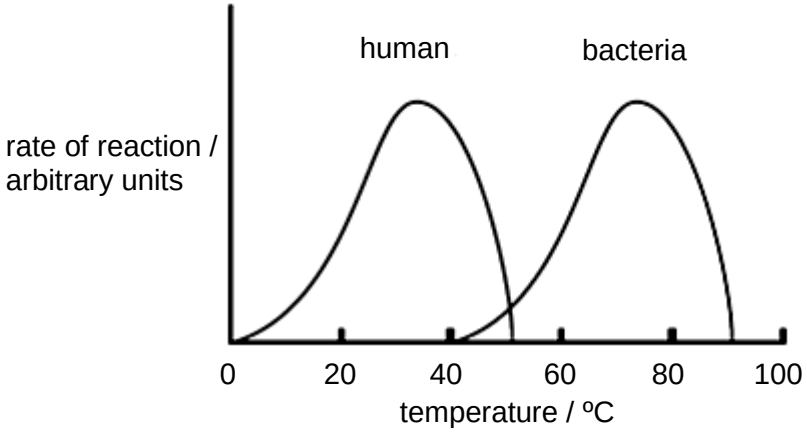
The diagram shows the chromatography results:



Which row shows the correct results?

	sucrose	cellulose	products of complete hydrolysis of sucrose	products of complete hydrolysis of cellulose
A	4	3	1	2
B	3	4	2	1
C	1	2	3	4
D	2	1	4	3

3 The rate of reaction of a typical human enzyme was compared with the rate of reaction of a typical enzyme taken from bacteria that live in hot springs. The rates of reaction were measured over the same range of temperatures. The data obtained is shown in the following diagram.



Which statement can be concluded?

A Typical human enzymes fail to act at temperatures above 50ºC as they are denatured due to disruption of covalent bonds.

B The temperature coefficient for typical enzymes from bacteria that live in hot springs is two for temperatures between 45ºC to 75ºC.

C A denatured human enzyme would resume activity if reincubated at 20ºC.

D Enzymes from bacteria that live in hot springs withstand temperatures up to 90ºC as they have a low K_m value.

4 A group of diploid cells with x amount of DNA and 36 chromosomes each is capable of undergoing mitosis and meiosis.

During which stage(s) could a cell with 2x amount of DNA and 72 chromosomes be found?

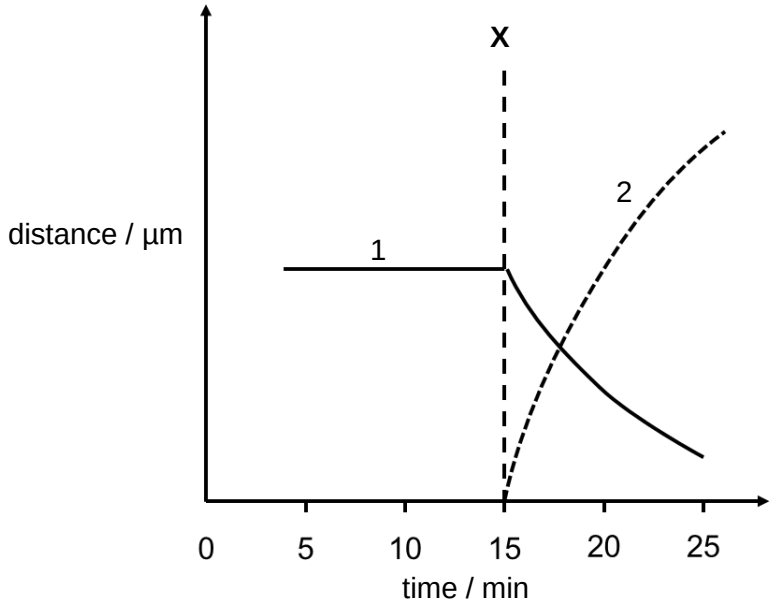
A anaphase of mitosis only

B anaphase of meiosis I only

C anaphase of mitosis and anaphase of meiosis I

D anaphase of mitosis and anaphase of meiosis II

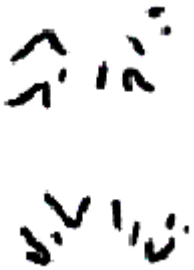
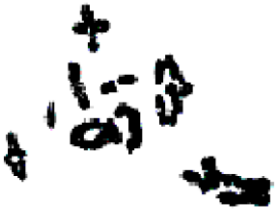
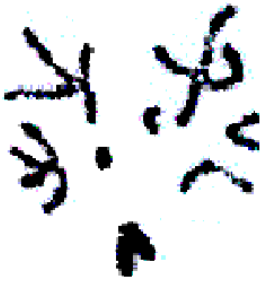
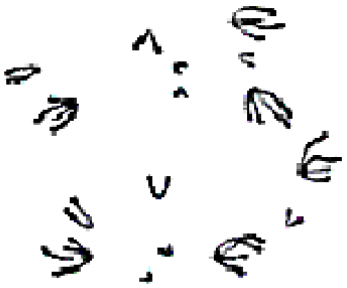
5 The graph shows measurements during one mitotic cell cycle.



What is the behaviour of chromosomes from **X** onwards as illustrated by curves 1 and 2?

	behaviour of chromosomes	curve 1	curve 2
A	separation of sister chromatids	distance between the centromeres of sister chromatids	distance between centromeres of chromosomes and poles of spindle
B	separation of sister chromatids	distance between centromeres of chromosomes and poles of spindle	distance between the centromeres of sister chromatids
C	separation of homologous chromosomes	distance between centromeres of chromosomes and poles of spindle	distance between the centromeres of homologous chromosomes
D	separation of homologous chromosomes	distance between the centromeres of homologous chromosomes	distance between centromeres of chromosomes and poles of spindle

6 The diagram shows some of the events that take place during meiosis.

1 	2 	3 
4 	5 	6 

Which sequence of events is correct?

A 6 → 5 → 3 → 2 → 4 → 1

B 6 → 3 → 5 → 4 → 2 → 1

C 3 → 2 → 6 → 4 → 1 → 5

D 3 → 6 → 2 → 4 → 5 → 1

7 Samples of DNA were taken from four individuals and processed as shown in the flowchart.

original samples	 DNA sample 1	 DNA sample 2	 DNA sample 3	 DNA sample 4
step **X** – separation of the DNA strands in samples 1 to 4 ↓				
samples after step **X**	 DNA sample 1	 DNA sample 2	 DNA sample 3	 DNA sample 4
step **Y** – mixing of some samples and treatment of mixed samples ↓				
mixture of samples		 DNA samples 1 and 2	 DNA samples 1 and 3	 DNA samples 3 and 4

Which conclusion is correct?

A Samples 1 and 2 are from individuals belonging to the same species.

B Treatment at step **X** included cooling each of the original samples.

C Treatment of mixed samples at step **Y** included the addition of DNA helicase.

D Individuals belonging to samples 1 and 3 are more closely related than individuals belonging to samples 3 and 4.

8 Which statement(s) about RNA is / are correct?

1 It is less stable than DNA as it contains a ribose sugar that lacks a 2' OH group.

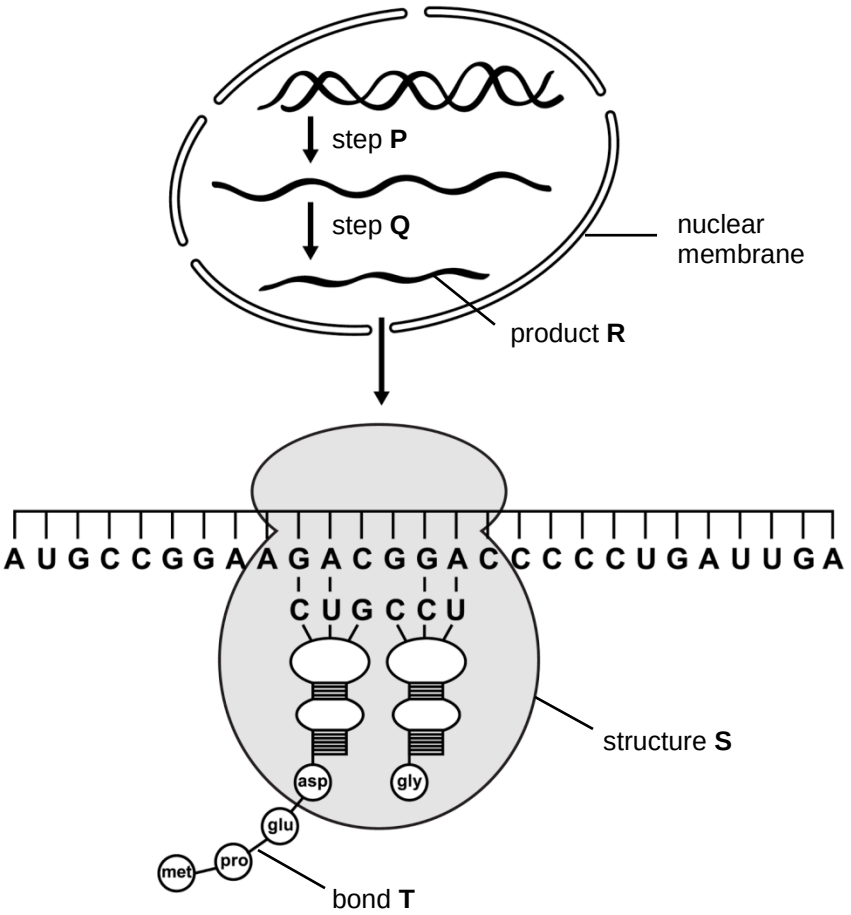
2 It is able to form double-stranded regions with some areas of base pairing.

3 It is a polymer of purine and pyrimidine joined by phosphodiester bonds.

4 It is synthesised in the 5' to 3' direction where the 5'-phosphate group of the growing RNA strand is joined to the 3'-hydroxyl group of an incoming nucleotide.

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

9 The diagram outlines the production of protein in a cell.



Which statements are correct?

1 DNA involved has the base sequence TACGGCCTTCTGCCTGGGGGACTAACT.

2 RNA polymerase is active during step **P** and removal of exons by spliceosome occurs at step **Q** to give product **R**.

3 Bond **T** is synthesised by RNA found in structure **S**.

4 The mRNA shown will code for a protein containing eight amino acids.

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

10 Haemoglobin consists of four polypeptide chains. In normal adult haemoglobin, two of these are beta chains, each comprising 146 amino acids. Variations exist in the amino acid composition of these chains, resulting in different kinds of haemoglobin. One of these variants is called haemoglobin S.

The first seven amino acids in the beta chains of these two haemoglobins are given below. The amino acids at each of the remaining positions are the same for both kinds of haemoglobin.

position of amino acid in haemoglobin chain:	**1**	**2**	**3**	**4**	**5**	**6**	**7...**
normal adult haemoglobin:	val	his	leu	thr	pro	glu	glu...
haemoglobin S:	val	his	leu	thr	pro	val	glu...

The genetic code for the amino acids in these sequences, coded for by the template strand of DNA, is shown in the following table.

DNA triplet	amino acid	DNA triplet	amino acid
CAA or CAG or CAT or CAC	val	TGA or TGG or TGT or TGC	thr
GTA or GTG	his	GGA or GGG or GGT or GGC	pro
AAT or AAC or GAA or GAG or GAT or GAC	leu	CTT or CTC	glu

Using the information provided above, which statement(s) is / are true about normal adult haemoglobin and haemoglobin S?

1 During transcription of normal haemoglobin, the mRNA codon sequence could be CAC for amino acid 2 and GAA for amino acid 7.

2 Haemoglobin S could be the result of a single base mutation in the DNA of normal adult haemoglobin.

3 A deletion of nucleotide 12 would not change the fourth amino acid in the sequence of normal adult haemoglobin.

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

11 A strain of *Escherichia coli* contains the following mutations in its *lac* operon:

lac I $^{-}$	pro $^{-}$	o $^{+}$	*lac Z* $^{+}$	*lac Y* $^{+}$	*lac A* $^{-}$

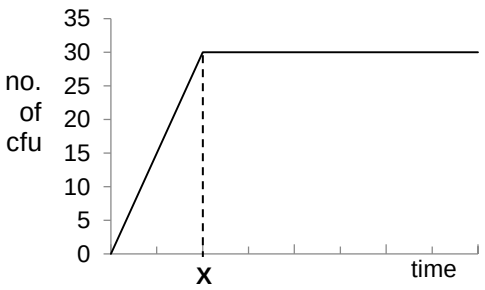
key

+	: presence of normal allele	pro	: promoter
-	: absence of normal allele	o	: operator

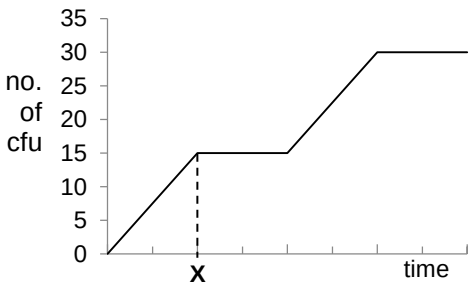
This mutant strain of *E. coli* was initially grown in the presence of glucose. At time **X**, glucose was depleted and lactose added.

Which graph best represents the total number of colony forming units (cfu) in this strain?

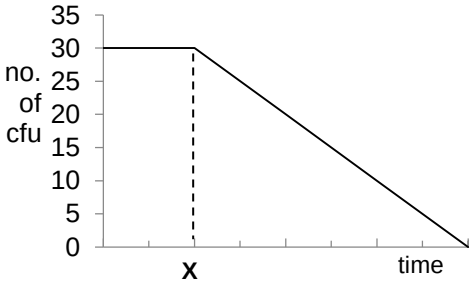
A



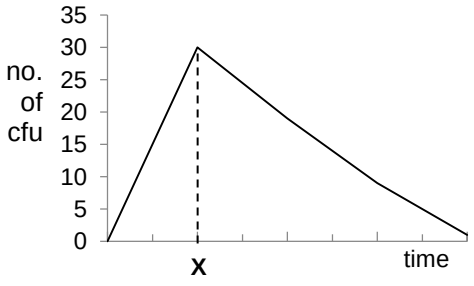
B



C



D



12 Which is the correct sequence of stages in the reproductive cycle of lambda phage?

1 bacteriophage tail fibres attach to receptors on the bacterial cell membrane

2 bacteriophage genome inserted into host genome via homologous recombination

3 bacteriophage enzymes break down bacterial DNA

4 bacteriophage nucleic acid, enzymes and other proteins injected into bacteria cell

5 new bacteriophage assembled

6 bacteriophage DNA replicates and codes for new bacteriophage proteins

7 release of bacteriophages

A 5 → 7 → 3 → 4 → 2 → 1 → 6

B 5 → 7 → 1 → 4 → 6 → 2 → 3

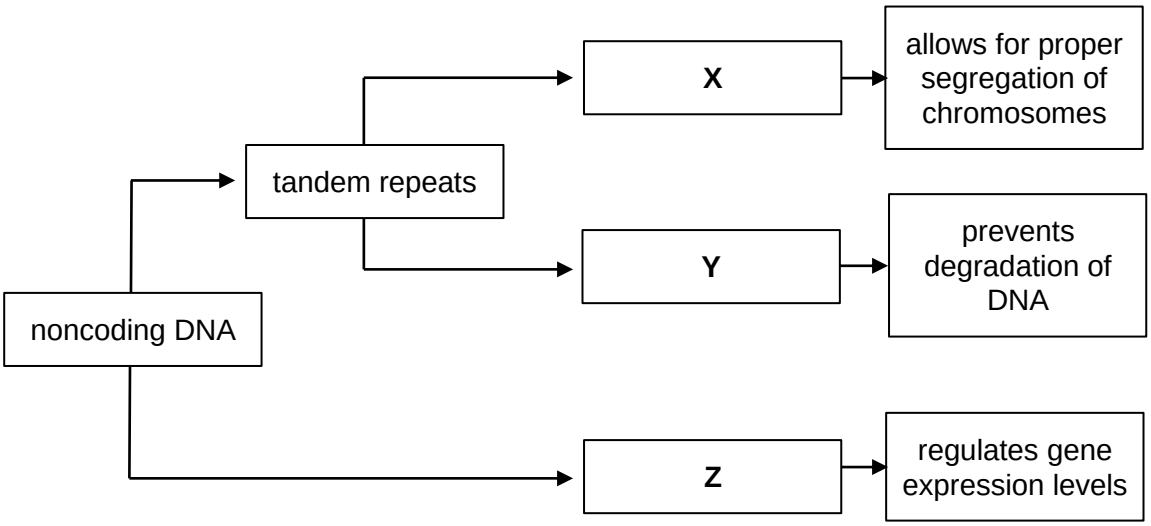
C 1 → 4 → 2 → 3 → 6 → 5 → 7

D 1 → 5 → 2 → 3 → 6 → 7 → 4

13 Which combination correctly describes plasmids, prokaryotic and eukaryotic chromosomes?

	circular	double-stranded DNA	associated with histone proteins	presence of origin of replication	replicated during mitosis
A	✓	×	×	×	✓
B	✓	✓	✓	×	×
C	×	×	✓	✓	✓
D	×	✓	×	✓	×

14 The flowchart shows the classification of several regions of noncoding eukaryotic DNA, **X**, **Y** and **Z**.



Which statement(s) correctly describes **X**, **Y** and **Z**?

1 Regions **X** and **Y** are made up of transcriptionally active tandem repeats.

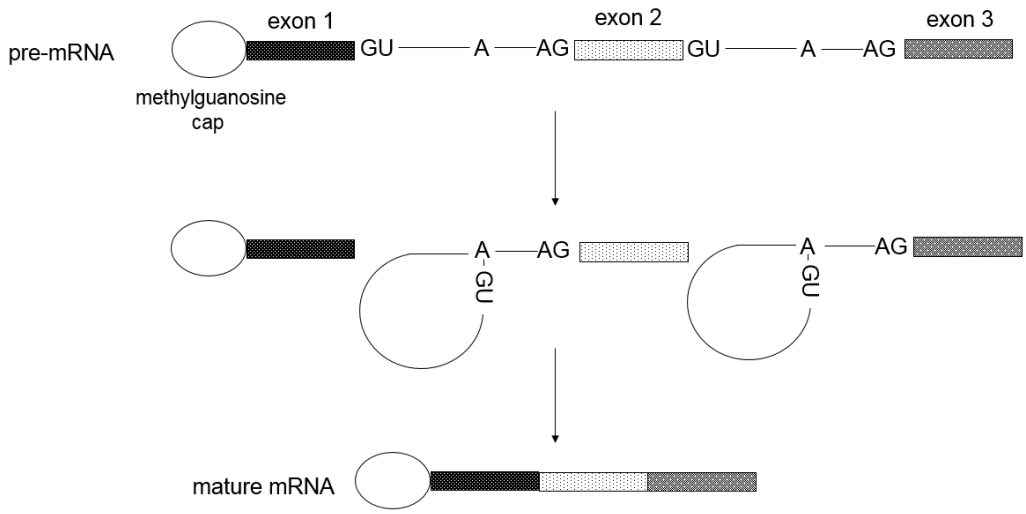
2 Regions **X** and **Y** are always associated with proteins, but DNA at region **Z** is only associated with proteins during gene expression.

3 Region **Z** may contain introns but region **Y** does not.

4 Regions **X**, **Y** and **Z** are conserved throughout the life of the organism.

A 2 **B** 3 **C** 1 and 4 **D** 2 and 3

15 The diagram shows part of an mRNA undergoing the process of splicing.



Which statement(s) is / are related to the process shown?

1 RNA splicing occurs after the release of pre-mRNA from RNA polymerase.

2 Spliceosome binds to the 3' splice site GU and the 5' splice site AG on the pre-mRNA.

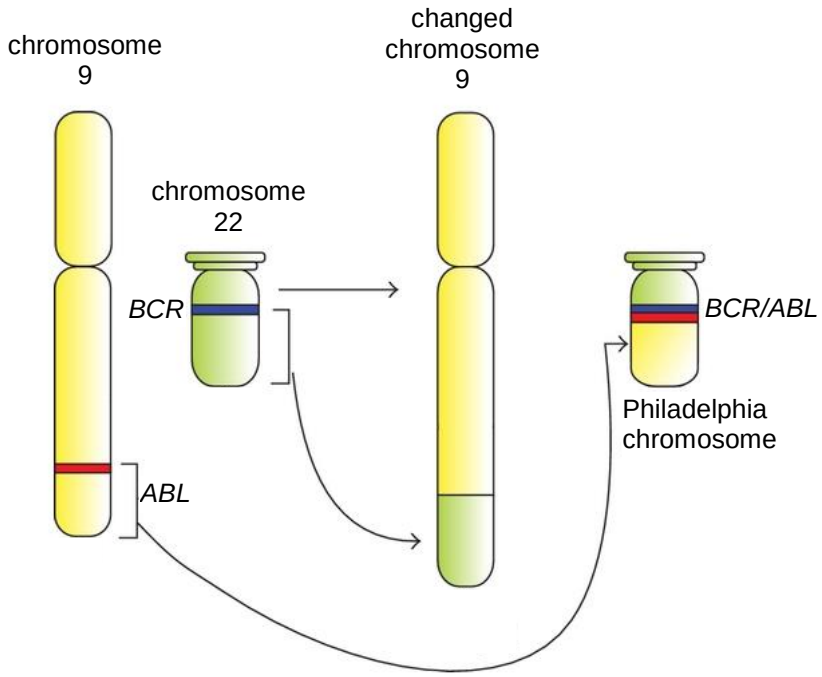
3 A RNA loop is formed on the pre-mRNA where the intron is excised.

4 There can be more than one type of product formed from a single pre-mRNA.

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

16 In normal cells, the *ABL* gene encodes an enzyme, tyrosine kinase, which is part of the cell signalling pathway leading to cellular proliferation.

The diagram shows a chromosomal translocation that forms the Philadelphia chromosome. The fusion *BCR/ABL* gene expresses an abnormal fusion protein. The presence of the Philadelphia chromosome is linked to the development of chronic myeloid leukaemia (CML), a cancer of the white blood cells.



Which statement is correct?

A The *BCR/ABL* gene is under the control of a constitutively active promoter of the *BCR* gene, resulting in quantitative changes that lead to oncogene formation.

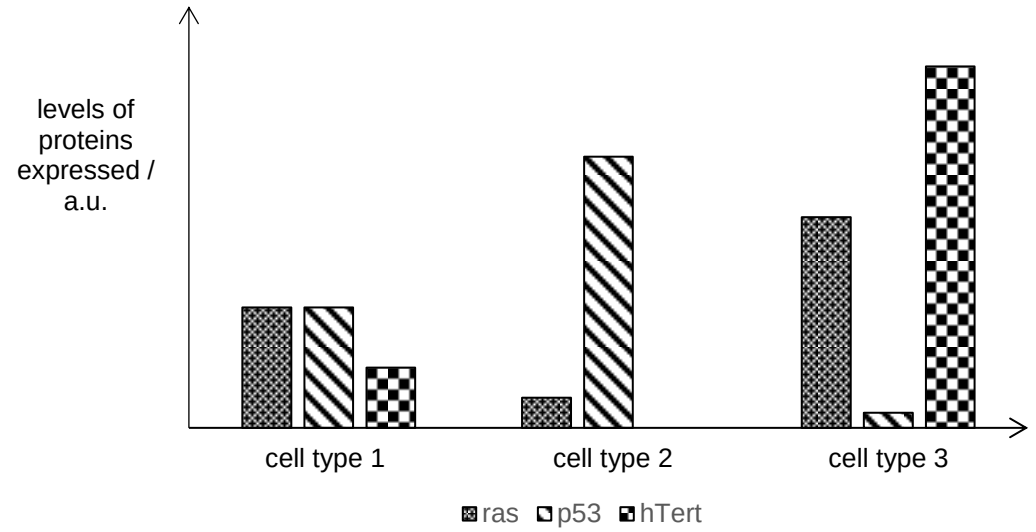
B The BCR/ABL protein causes the rate of cell division to exceed the rate of cell death.

C Chromosomal translocation of both the copies of *ABL* gene is required before CML can develop.

D In CML, both angiogenesis and metastasis have to occur.

17 Cancer critical genes include *ras, p53* and *hTert*. *hTert* codes for human telomerase.

The levels of proteins expressed by each gene in three different cell types of a patient are shown in the graph. Only one of the cell types is taken from a malignant tumour.



Which statement is true?

A Cell type 1 is not from the malignant tumour since balanced expression of *ras* and *p53* halts cell cycle progression.

B Activation of telomerase will result in cell type 2 gaining immortality and becoming cancerous.

C Cell type 3 is obtained from the malignant tumour as the cells have overcome the Hayflick limit.

D Gain-of-function mutation of *hTert* in cell type 1 will result in malignant tumour formation.

18 During summer, an isolated population of bighorn sheep on Ram Mountain has been captured and the length of their curled horns was measured over 30 years. Horn length of bighorn sheep follows a distribution similar to that of its weight.

Which statements describing the features of horn length in the bighorn sheep are **incorrect**?

1 multiple alleles with different degrees of dominance

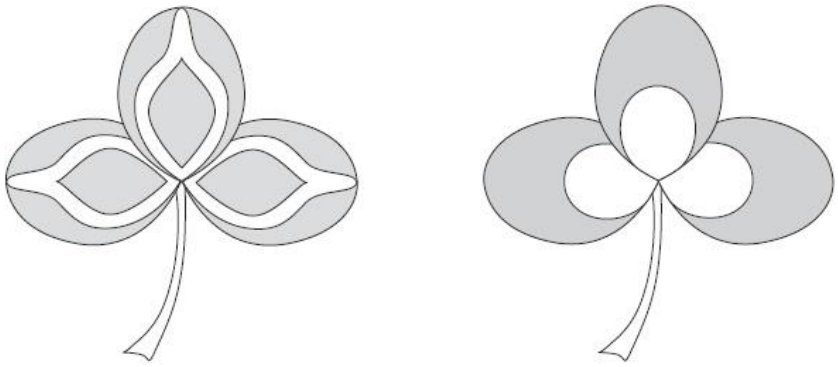
2 quantitative expression with overlaps between categories

3 polygenic where inherited individual alleles have an additive effect

4 not affected by the environment

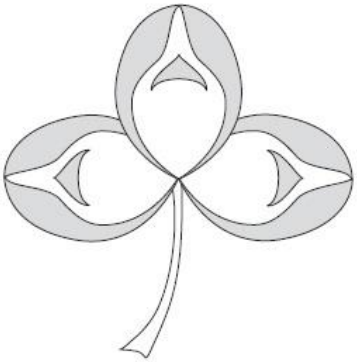
A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

19 The white clover, *Trifolium repens*, is one of the plants found growing as a weed in many lawns. Leaves of the white clover are divided into three leaflets, which often have characteristic white patterns visible on their surface. The two basic forms of the pattern are a chevron and patch. The diagram below shows these two patterns.



chevron pattern patch pattern

If a pure-breeding clover plant with the chevron pattern is crossed with a pure-breeding plant with the patch pattern, the offspring have leaflets with a mixed chevron and patch pattern, as shown in the diagram below.



mixed pattern

Which row correctly describes the inheritance of leaflet patterns in white clover?

	number of alleles that determines the white patterns in the leaflets	mode of inheritance
A	2	codominance
B	2	epistasis
C	> 2	codominance
D	> 2	epistasis

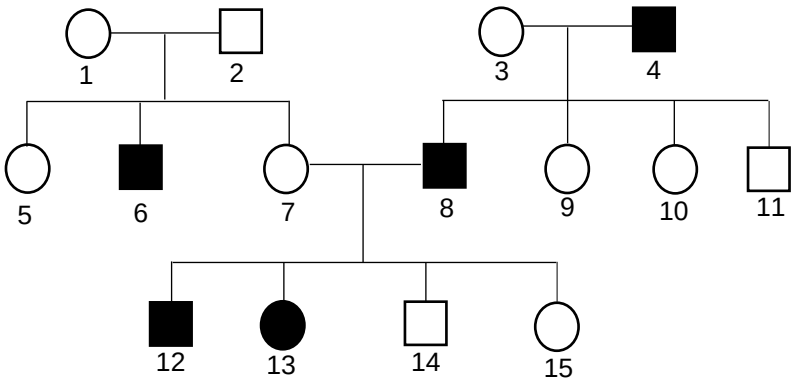
20 Wild-type fruit flies, *Drosophila melanogaster,* have red eyes. The red pigment, drosopterin, is derived from the amino acid tryptophan in two steps, each controlled by a different gene.

Flies that were each heterozygous for both genes were mated. The offspring had three different eye colours in a ratio of 9 red-eyed flies : 3 brown-eyed flies : 4 cinnabar-eyed flies.

Which cross between the respective parental fruit flies is **unable** to produce the offspring listed?

	parents		offspring	
A	brown-eye	cinnabar-eye	cinnabar-eye	red-eye
B	cinnabar-eye	cinnabar-eye	red-eye	brown-eye
C	red-eye	brown-eye	brown-eye	cinnabar-eye
D	brown-eye	red-eye	red-eye	red-eye

21 The pedigree shows the inheritance of red-green colour-blindness.



Which statement about this pedigree is correct?

A Individual 3 must be a carrier who passed down the recessive allele to her son.

B Individual 11 does not have colour-blindness since he is homozygous dominant.

C To get a colour-blind daughter 13, individual 7 must be either heterozygous or homozygous recessive.

D If individual 13 marries a normal man, the probability of their sons being colour-blind is 50%.

22 In the breeding season, male Anole lizards court females by bobbing their heads up and down while displaying a colourful throat patch. Both characteristics are controlled by genes found on separate chromosomes. Anoles prefer to mate with lizards, which bob their heads fast and have red throat patches. These two alleles are dominant over their counterparts, slow bobbing and yellow throats.

A male lizard heterozygous for head bobbing and homozygous dominant for the red throat patch mates with a female that is also heterozygous for head bobbing but has yellow throat patch.

What percentage of the offspring has fast bobbing and red throat phenotype?

A 25% **B** 50% **C** 75% **D** 100%

23 A plant with orange-spotted flowers was grown in a greenhouse from a seed collected in the wild. The plant was self-pollinated and gave rise to the following progeny: 129 plants with orange-spotted flowers, 22 plants with yellow-spotted flowers, 26 plants with solid orange flowers, and 15 plants with solid yellow flowers.

The formula for the chi-squared (χ^2) test is given as follows:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

degrees of freedom	probability			
	0.10	0.05	0.01	0.001
1	2.71	3.84	6.64	10.83
2	4.69	5.99	9.21	13.82
3	6.25	7.82	11.35	16.27
4	7.78	9.49	13.28	18.47

Which statement is true about the inheritance of flower colour and flower pattern?

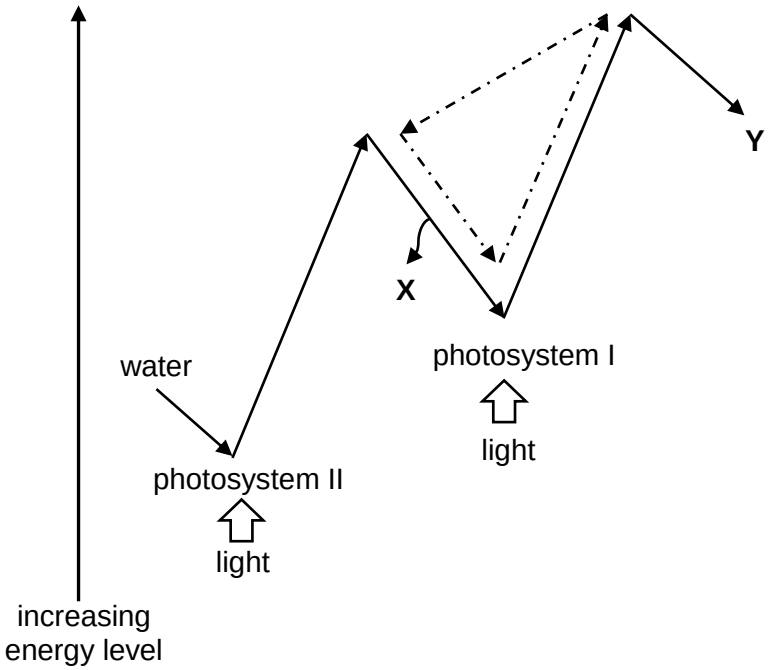
A Since p < 0.05, the difference between the observed and expected results is not significant. The inheritance of flower colour and flower pattern is following Mendel's law of independent assortment.

B Since p > 0.05, the difference between the observed and expected results is not significant. The inheritance of flower colour and flower pattern is not following Mendel's law of independent assortment.

C Since p < 0.01, the difference between the observed and expected results is not significant. The inheritance of flower colour and flower pattern is following Mendel's law of independent assortment.

D Since p < 0.01, the difference between the observed and expected results is significant. The inheritance of flower colour and flower pattern is not following Mendel's law of independent assortment.

24 The diagram outlines the light-dependent stage of photosynthesis in which products **X** and **Y** are formed.



Which statements are true?

1 PSI has a higher energy level due to higher light intensity.

2 Electrons from PSII will always be used to form **Y**.

3 Water is always necessary for the formation of **X**.

4 Cyclic flow of electrons results in the formation of **X**.

5 Non-cyclic photophosphorylation is needed for oxidation of **Y**.

A 2 and 4 **B** 3 and 5 **C** 1, 3 and 5 **D** 2, 3 and 4

25 The more sunlight a plant receives, the higher the photosynthetic rate.

If light intensity is kept uniformly high, which of the following statements is true of the rate of photosynthesis?

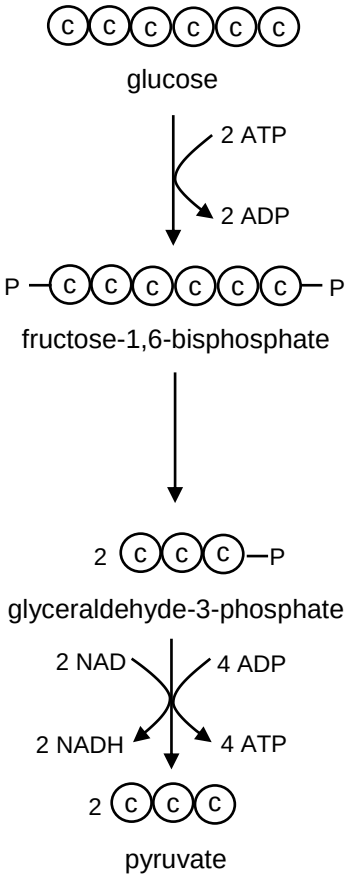
A Carbon dioxide is limiting when temperature is high while carbon dioxide concentration is high.

B Carbon dioxide is limiting when temperature is high while carbon dioxide concentration is low.

C Temperature is limiting when temperature is low while carbon dioxide concentration is low.

D Temperature is limiting when temperature is high while carbon dioxide concentration is low.

26 The flowchart shows some of the crucial steps in the glycolytic pathway involving one glucose molecule.



Which shows the correct arrangement of the respective molecules according to the number of ATP produced upon completion of aerobic respiration?

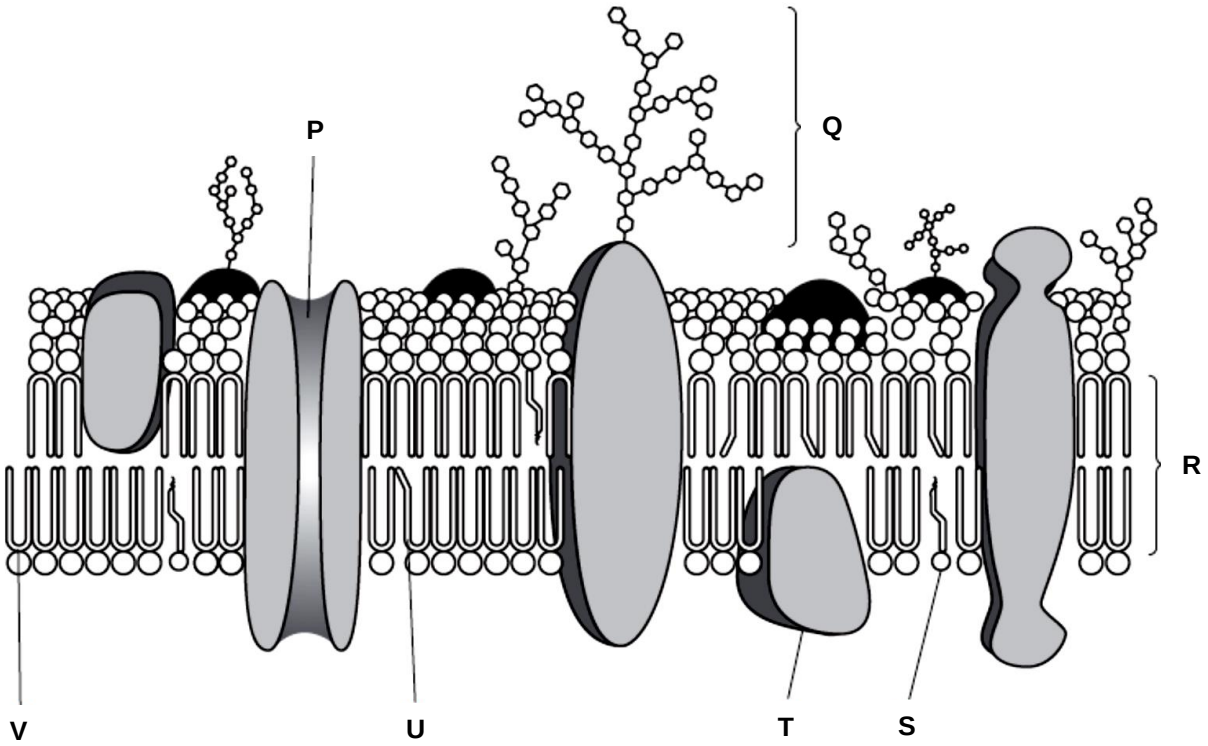
A reduced NAD < glucose < glyceraldehyde-3-phosphate

B reduced NAD < glyceraldehyde-3-phosphate < glucose

C glyceraldehyde-3-phosphate < glucose < reduced NAD

D glucose < glyceraldehyde-3-phosphate < reduced NAD

27 The diagram shows a section through a cell surface membrane from an animal cell.



When compared to the more fluid cell surface membrane of a phagocytic cell, a number of differences in the membrane composition can be observed.

Which is the most likely set of differences that will be observed in the phagocytic cell?

A a complete absence of component **Q** and a higher proportion of component **P**

B a higher proportion of component **S** and a higher proportion of component **T**

C a lower proportion of component **V** and a higher proportion of component **U**

D an increased distance across **R** and a higher proportion of component **V**

28 The table shows the results of an experiment comparing rates of glucose production by a group of patients with type II diabetes and a control group of healthy individuals, during 23 hours of fasting.

	rate of glucose production per unit body mass / µmol min^{-1} kg^{-1}	
	patients with type II diabetes	control group
total glucose production	11.1 ± 0.6	8.9 ± 0.5
glucose from glycogenolysis in the liver	1.3 ± 0.2	2.8 ± 0.7
glucose from gluconeogenesis	9.8 ± 0.7	6.1 ± 0.5

Which statement **cannot** be concluded from the experiment?

A More glucose is produced by a starving person with type II diabetes than by a person without the condition.

B The diabetic is less able to regulate the blood glucose concentration due to more advanced stage of starvation.

C In type II diabetes, more glucose is produced by gluconeogenesis as compared to glycogenolysis.

D Although glycogen is available, the diabetic is unable to utilise much of the glycogen store in the liver into glucose.

29 A particular snake venom causes death by leading to paralysis of muscles. It exerts its effect at synapses.

The statements below were put forward as possible explanations for the effects of this venom.

1 It interferes with the binding of neurotransmitter vesicles to the membranes.

2 It binds with neurotransmitter receptor sites.

3 It blocks calcium and sodium channels.

4 It destroys the myelin sheath of the neurone.

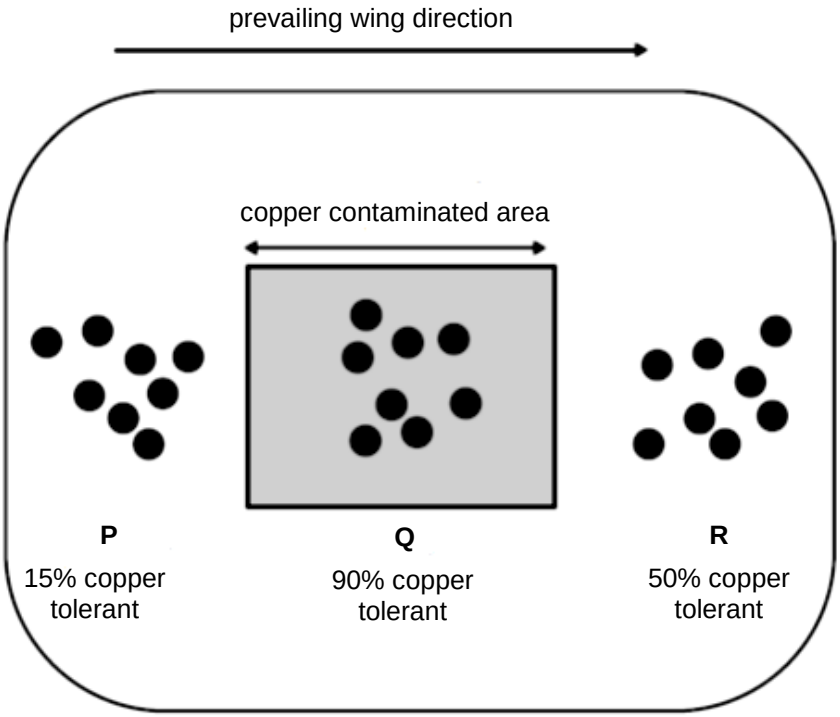
5 It binds with neurotransmitter.

Which statement(s) should be investigated further?

A 4 **B** 2, 4 and 5 **C** 1, 2, 3 and 5 **D** 1, 2, 3, 4 and 5

30 Copper tolerance in grass is genetically determined. The following is a diagrammatic representation of an aerial view of a region found in Great Britain that includes:

- a section of copper contaminated soil (shaded grey)
- populations of grass growing in areas **P**, **Q** and **R** (solid circles)
- percentage of copper resistant plants in areas **P**, **Q** and **R**.



It is reasonable to conclude from the information that

A all plants in the copper contaminated area would be homozygous at the gene locus for copper tolerance.

B high levels of copper tolerance would be a selective advantage for all plants in areas **P**, **Q** and **R**.

C the difference in copper tolerance between populations in areas **P** and **R** is the result of mutation.

D gene flow is occurring between populations in areas **Q** and **R**.

31 In some autosomal recessive conditions in humans, the homozygous recessive genotype results in death before reproductive age. Despite this, the allele for the recessive trait is maintained in the population.

Which explains the maintenance of the recessive allele in the population?

A Mutation

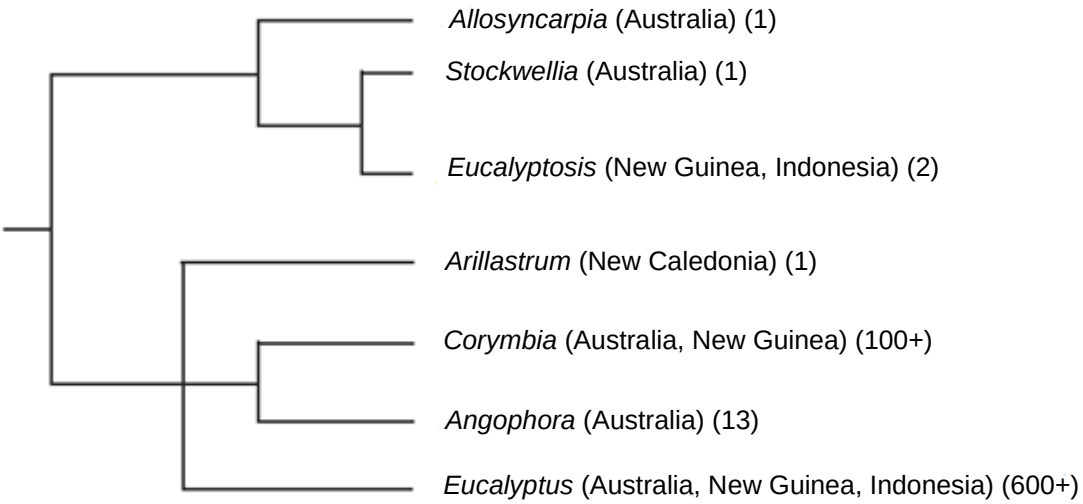
B Migration between populations

C The heterozygote is biologically fitter than either of the homozygous genotypes.

D Individuals with the homozygous dominant genotype produce more offspring in each generation.

32 Eucalypts, commonly known as gum trees, are Australian trees. They have been recently classified into seven different genera on the basis of nuclear and chloroplast DNA sequencing.

A proposed phylogeny for the seven genera is shown in the diagram, along with the countries in which they are found.



key: Numbers in brackets ( ) refer to the numbers of species in the genus.

Which statement is correct?

A *Eucalyptosis* evolved from *Allosyncarpia* as they share a more recent common ancestor.

B Speciation in *Eucalyptus* was assisted by different selecting pressures.

C The greater the number of species in a genus, the younger the genus.

D The genus that evolved most recently was *Angophora*.

33 Genetic engineers use restriction enzymes to cut DNA into shorter fragments. The restriction site of *Eco*RI is shown in the table. The symbol * denotes the position of the cut.

restriction enzyme	restriction site (read in 5' to 3' direction)
*Eco*RI	G* A A T T C C T T A A *G

Consider the double-stranded DNA sequence shown below:

5' - T T A A G G A A T T C A A - 3'
3' - A A T T C C T T A A G T T - 5'

Adding *Eco*RI to a solution containing one copy of this double-stranded DNA produces

A two fragments of double-stranded DNA, each with a sticky end.

B four fragments of single-stranded DNA, each with a sticky end.

C two fragments of double-stranded DNA, each with blunt ends.

D four fragments of single-stranded DNA, each with blunt ends.

34 PCR is commonly used to amplify DNA.

What is the expected effect on the PCR reaction as a result of adjustments that increase the temperature of the annealing phase and the length of the extension phase?

	precision	yield
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

35 Human nerve cell DNA was treated with the restriction enzyme *Eco*RI, inserted into plasmids and transformed into *Escherichia coli*. Using the whole genome shotgun technique, every human DNA sequence is represented in a library of *E. coli* clones.

How would an *E. coli* clone that bears a gene encoding a particular human tRNA be identified?

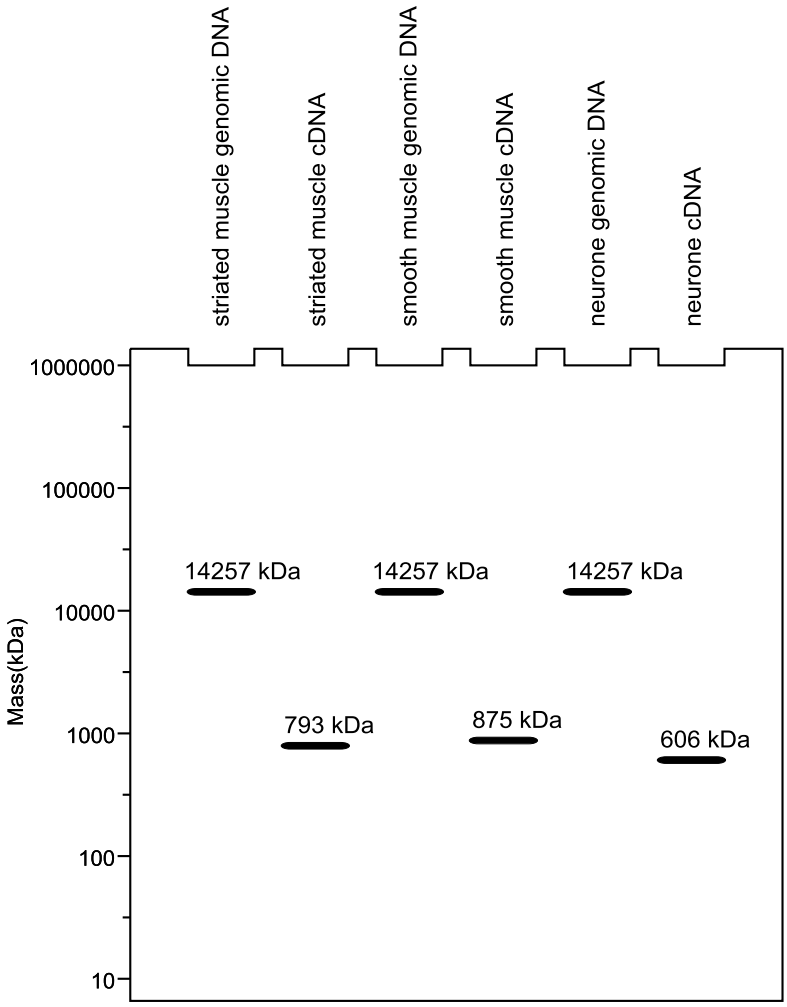
A Culture the *E. coli* clone and determine if the corresponding human protein is synthesised.

B Perform a *Eco*RI restriction digest of the RNA from the *E. coli* clone, separate the restriction fragments on an agarose gel, stain the gel and look for a fragment that corresponds to the length of the tRNA.

C Perform a *Eco*RI restriction digest of the DNA from the *E. coli* clone, separate the restriction fragments on an agarose gel, stain the gel and look for a fragment that corresponds to the length of the tRNA.

D Perform a *Eco*RI restriction digest of the DNA from the *E. coli* clone, separate the restriction fragments on an agarose gel, blot the fragments onto a nitrocellulose membrane and look for a fragment that hybridises with a single-stranded DNA probe.

36 Nucleic acid hybridisation analysis was performed on the *tropomyosin* gene from various human cells.



Which explains the results shown on the blot?

A DNA methylation

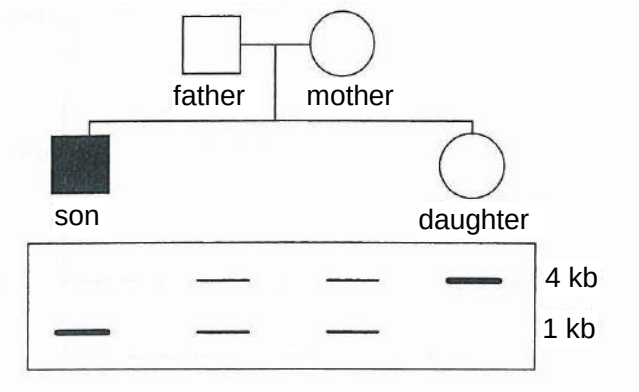
B alternative splicing

C different start codons in different tissues

D gene amplification

37 The *hexosaminidase A* gene encodes an enzyme responsible for normal brain function. Tay-Sachs disease is an autosomal recessive disorder, in which mutations in the *hexosaminidase A* gene lead to hexosaminidase A enzyme deficiency.

A couple's son has Tay-Sachs disease. The couple also has a daughter. The family's pedigree, along with Southern blots of an RFLP locus very closely linked to the *hexosaminidase A* gene, is shown.



Which statement correctly describes the daughter?

A She is a carrier for Tay-Sachs disease.

B She is homozygous dominant.

C She has a 25% chance of having Tay-Sachs disease.

D She has a 50% chance of having Tay-Sachs disease.

38 The Human Genome Project facilitated genetic testing of individuals and renewed emphasis on ethical and social implications.

Which correctly describes unintended consequences of genetic testing?

1 discovery of wrongly attributed paternity

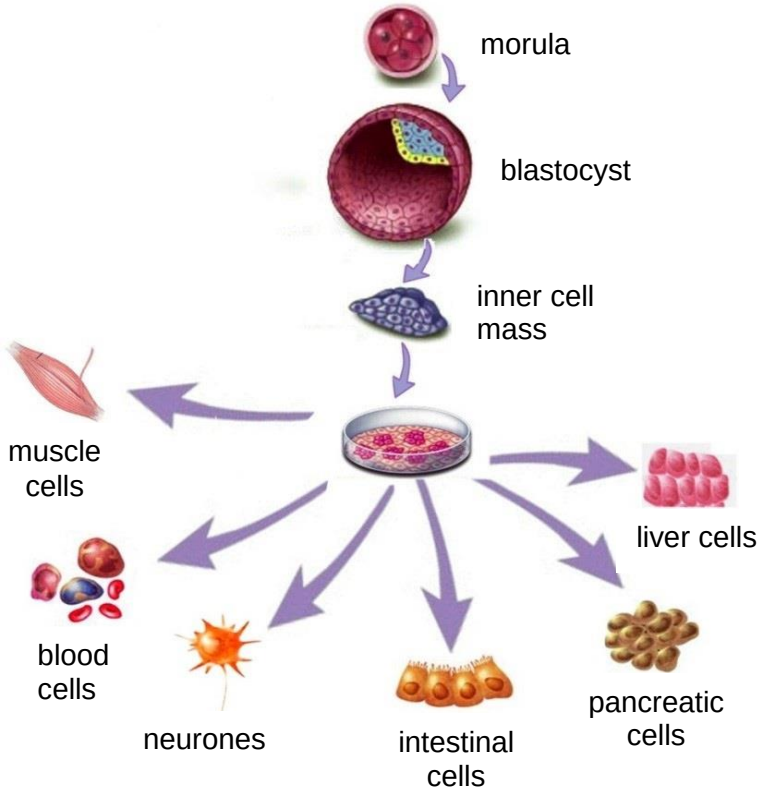
2 unauthorised publication of genetic test results

3 psychological stress after receiving genetic test results

4 understanding an individual's susceptibility to genetic disorders

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

39 The diagram shows the process of stem cells differentiating into their various cell types.



Which statements are true?

1 Neurones possess less genes than cells isolated from the inner cell mass.

2 All cells in the blastocyst are totipotent.

3 Stem cells differentiate to muscle cells and liver cells due to different environmental cues.

4 The potential of pancreatic cells and the intestinal cells to differentiate is equal.

A 1 and 3 **B** 1 and 4 **C** 2 and 4 **D** 3 and 4

40 Which statement supports the view that genetically engineered animals could help to solve the demand for food in the world?

A Transgenic pigs and sheep are produced to express higher levels of growth hormone.

B Biomedical applications of genetically engineered animals have also become routine within the pharmaceutical industry, for drug discovery, drug development and risk assessment.

C Cloning of either extinct or endangered species such as thylacine and woolly mammoth helps to retain genetic diversity in small populations.

D By inserting genes from sea anemone and jellyfish, zebrafish have been genetically engineered to express fluorescent proteins.

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