

NAME: _____ CLASS: _____ INDEX: _____



CATHOLIC JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATIONS
Higher 1

Answers

BIOLOGY

Paper 1 Multiple Choice

8875/01

29th August 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write and/or shade your name, NRIC / FIN number and HT group on the Answer Sheet in the spaces provided unless this has been done for you.

There are **30 MCQ** 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 **2B pencil** on the separate **OMR Answer Sheet**.

Read the instructions on the Answer Sheet very carefully.

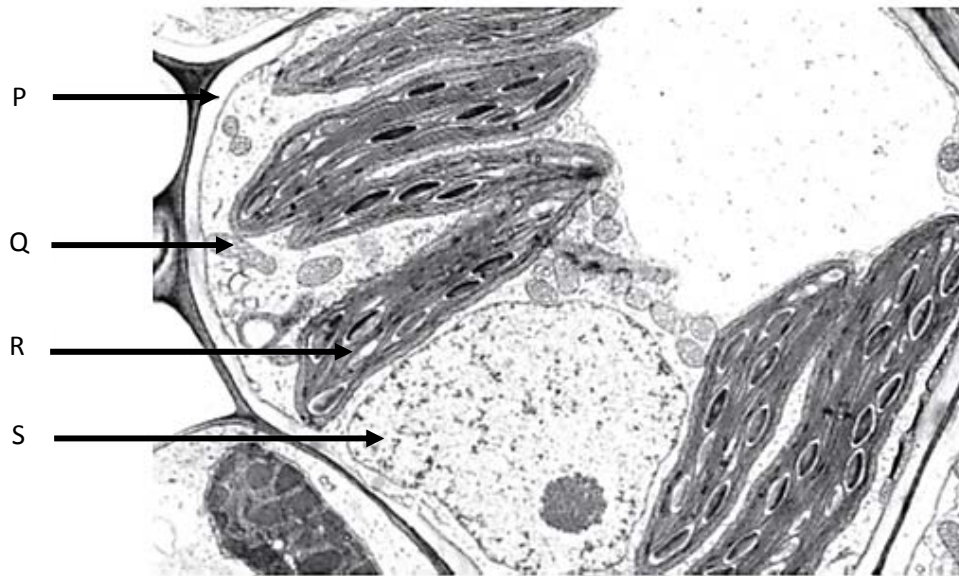
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Calculators may be used.

1	B	2	C	3	B	4	A	5	C
6	C	7	D	8	C	9	D	10	D
11	C	12	C	13	B	14	C	15	A
16	A	17	C	18	C	19	D	20	B
21	D	22	A	23	B	24	D	25	D
26	D	27	D	28	D	29	A	30	A

1. The electron micrograph of a cell is shown below.



The electron micrograph of a cell is shown below.

Which of the following statements are true?

- 1 Structure P is found in all eukaryotic cells.
- 2 Organelle Q contains hydrolytic enzymes.
- 3 Organelle R contains starch.
- 4 Organelle S contains heterochromatin but not euchromatin.
- 5 Organelles Q, R and S contain RNA polymerase.

- A** 1 and 3 only
B 3 and 5 only
C 1, 3 and 5 only
D 2, 3 and 5 only

Ans: B [L1] (ACJC H1 PRELIM 2015 P1.Q1)

1.1] Cell structure and Organisation – EM

SC: P- Cell Wall Q-Mitochondria R- Chloroplast

- OR:**
- 1 Structure P is found in all eukaryotic cells.
 - 2 Organelle Q contains hydrolytic enzymes.
 - 3 Organelle R contains starch.
 - 4 Organelle S contains heterochromatin but not euchromatin.
 - 5 Organelles Q, R and S contain RNA polymerase.

S- Nucleus

✗ Only Plant Cells

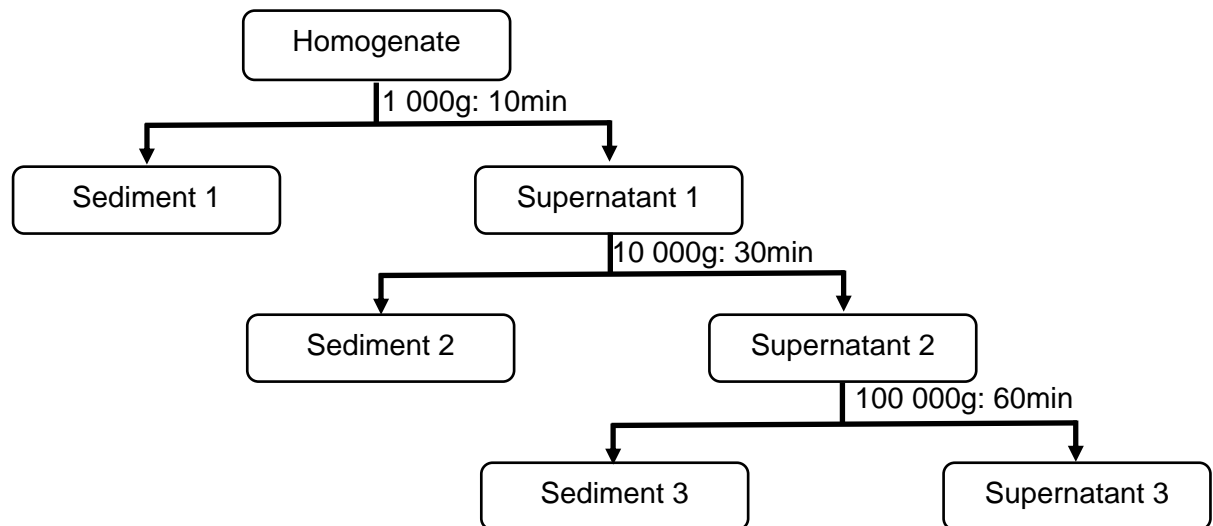
✗ Q is not a lysosome

✓

✗ Contains both

✓

2. The figure below shows a centrifugation schematic of a rat liver cell.



Which of the following statements is incorrect?

- A Sediment 1 contains organelles which are nucleic acid rich.
- B Sediment 2 contains organelles with carbohydrate and nucleic acid.
- C Supernatant 2 contains organelles that are the most dense amongst all other organelles.
- D Supernatant 3 contains organelles that are involved in protein synthesis.

SC: Sed1: Nucleus Sed2: Mitochondria and Chloroplast Sed3: ER, Golgi

OR: A Sediment 1 contains organelles which are nucleic acid rich

True

B Sediment 2 contains organelles which produce carbohydrate and nucleic acid

True ATP is a nucleic acid

C Supernatant 2 contains organelles that are the most dense amongst all other organelles. False nuclei are in Sediment 1

D Supernatant 3 contains organelles that are involved in protein synthesis

True- ribosomes

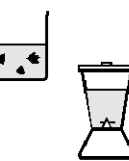
Ans: C [L2] Novel

1. Cut tissue (eg liver, heart, leaf, etc) in ice-cold isotonic buffer. Cold to stop enzyme reactions, isotonic to stop osmosis, and buffer to stop pH changes.

2. Grind tissue in a blender to break open cells.

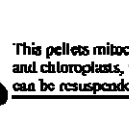
3. Filter. This removes insoluble tissue (eg fat, connective tissue, plant cell walls, etc). This filtrate is now called a cell-free extract, and is capable of carrying out most of the normal cell reactions.

4. Centrifuge filtrate at low speed (1 000 x g for 10 mins).



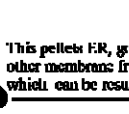
This pellets nuclei, which can be resuspended.

5. Centrifuge supernatant at medium speed (10 000 x g for 30 mins).



This pellets mitochondria and chloroplasts, which can be resuspended.

6. Centrifuge supernatant at high speed (100 000 x g for 1 hour).



This pellets ER, golgi and other membrane fragments, which can be resuspended.

7. Centrifuge supernatant at very high speed (300 000 x g for 3 hrs).



This pellets ribosomes, which can be resuspended.

8. Supernatant is now organelle-free cytoplasm

3. Which feature(s) of collagen is incorrect?

- 1 covalent bonds form between adjacent molecules
- 2 each three-stranded molecule is held together by intramolecular hydrogen bonds
- 3 every third amino acid in the polypeptide is small
- 4 the primary structure is held together by peptide bonds

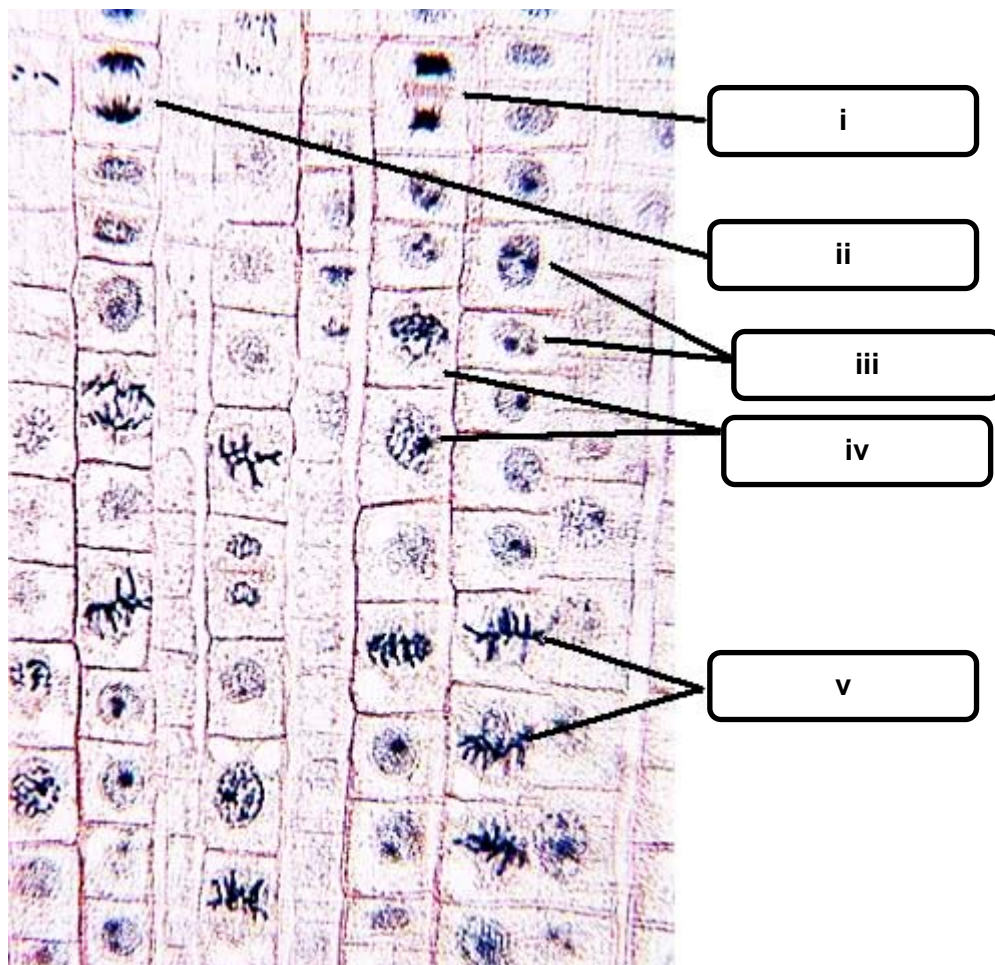
- A 1 only
B 2 only
C 1 and 4
D 2 and 3

SC: features / collagen / high tensile strength

OR: Option 1 ✓ parallel strands bring cystine groups together forming Disulphide cross bridges
Option 2 ✗ No hydrogen bonds across molecules
(where present will more likely be intermolecular)
Option 3 ✓ X,Y,Glycine the third being small allows a tight coil in each fibril
Option 4 ✓ Primary structure is a polypeptide chain comprising of peptide bonds.

Ans: B [L1] (modified 2015 IJC Prelim P1Q5)

4. The diagram below shows the longitudinal section of a root tip.



Which of the following correctly outlines the sequence in the stages of cell division in the root tip

- A $\text{iii} > \text{iv} > \text{v} > \text{ii} > \text{i}$
B $\text{iii} > \text{iv} > \text{i} > \text{v} > \text{ii}$

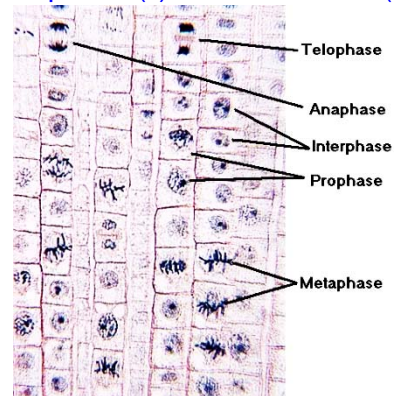
C iv > iii > v > ii > i

D iv > v > iii > i > ii

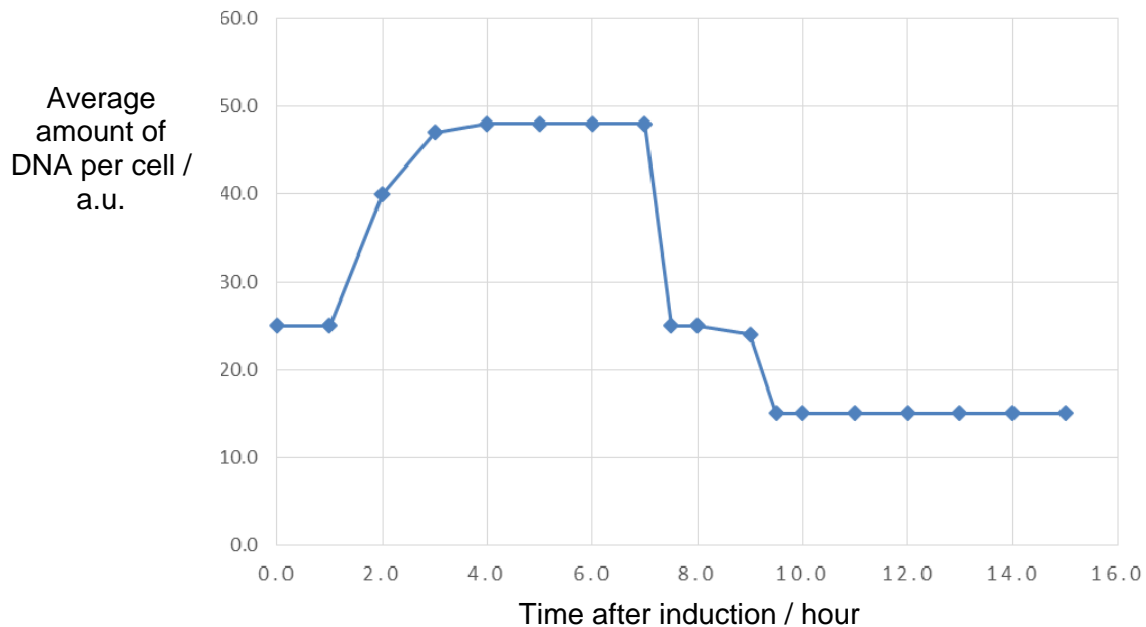
SC: correctly outlines seq in cell division

OR: Interphase (iii) >> Prophase (iv) >> Metaphase (v) >> Anaphase (ii) >> Telomerase (i)

Ans: A [L1] Novel



5. The figure below shows the average amount of DNA in a cell after induction.



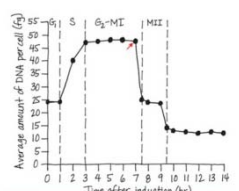
Which of the following correctly accounts for the trends seen?

	Time Frame after induction / hours	Ploidy level at the end of timeframe	Stage in Cell growth
A	0.0 to 1.0	2n	G2
B	1.0 to 3.0	4n	S
C	3.0 to 8.0	n	G2-Meiosis I
D	8.0 to 9.0	2n	Meiosis II

SC: cell after induction / correctly accounts

OR: A × Ploidy 2n ✓ stage is G1 not G2
 B × Ploidy 4n × stage S ✓ slow rise in DNA as replication increases DNA 2 fold
 C ✓ Ploidy n ✓ since after cytokinesis time 7 hrs Stage G2-MI ✓
 D × Ploidy 2n × sice it is after cytokinesis time 7 hrs Stage MII. ✓

Ans: C [L2] Novel



6. Which of the following is not required for transcription?

- A Ribonucleoside triphosphates
- B RNA polymerase
- C RNA primer
- D TATA box

SC: Need to know which factors play a role in transcription and which does not.

OR:

- ✓ A: Ribonucleoside triphosphates are the incoming monomers of transcription.
- ✓ B: RNA polymerase catalyses the process of transcription.
- X C: RNA primer is not required. It is required only for DNA replication.
- ✓ D: TATA box is where RNA polymerase and general transcription factors will bind to during initiation of transcription.

Ans: C [L1] Novel

7. A mutation had occurred on the template DNA strand which resulted in the polypeptide having the following sequence:

Met – Ser – Cys – Gly – Glu – Gln – His – Phe – Arg – Gly – Stop

The mRNA codon table is shown below.

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

If the normal non-mutated template DNA strand has the following sequence,

3' – TAC – TCA – ACA – ACC – TCT – TGT – CGT – GAA – GGC – CCA – ACT – 5'

Identify the mutation(s) that had occurred.

- A** Single base pair substitution
- B** Deletion
- C** Addition
- D** Deletion and addition

SC:

Template: 3' –TAC–TCA–ACA–ACC–TCT–TGT–CGT–GAA–GGC–CCA--ACT–5'

mRNA: 5'- AUG--AGU-UGU-UGG-AGA-ACA-GCA-CUU-CCG-GGU -UGA-3'

Protein: Met – Ser – Cys -Trp-Arg-Thr-Ala-Leu-Pro-Gly-Stop

Mutated protein: Met– Ser– Cys– Gly– Glu– Gln– His– Phe– Arg– Gly– Stop

OR:

- A: If it is a single base pair substitution, there will only be one amino acid changing.
- B & C: If it is addition or deletion the frame will not be reinstated at the back.
- D: Most likely an addition occurred which caused a frameshift mutation. This is followed by a deletion which caused a resetting of the frame towards the end of the amino acid sequence.

Ans: D [L3] Novel

8. Which of the following statements about DNA replication is true?

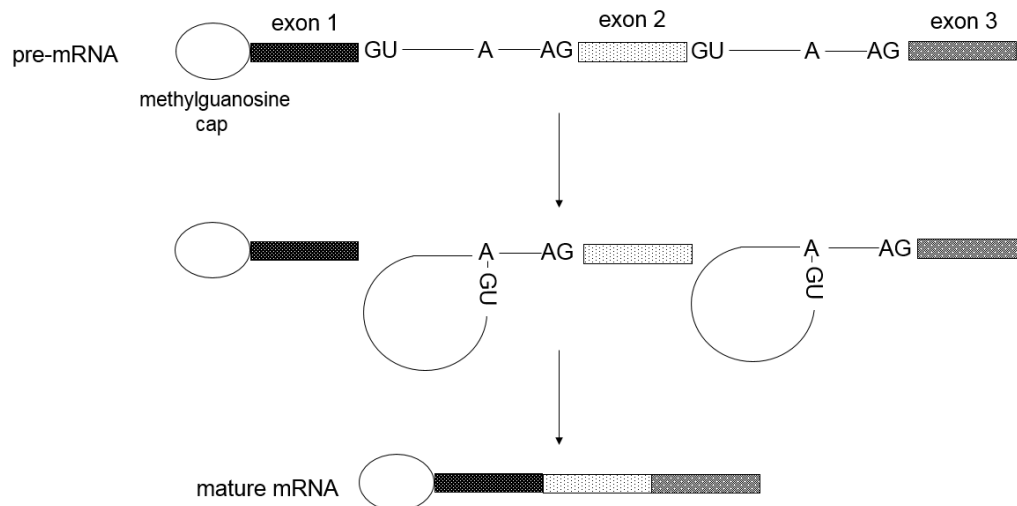
- A** During DNA replication, the synthesis of the leading strand occurs before that of the lagging strand.
- B** DNA polymerase III adds nucleotide pairs to the both the leading and lagging strands during elongation.
- C** During initiation, the enzyme helicase unzips and unwinds the DNA molecule for DNA replication to occur.
- D** DNA ligase catalyzes the formation of phosphodiester bonds between the 3' OH of the primer to the 5' phosphate group of the next Okazaki fragment.

SC: Recall DNA replication

OR: Option A ✗ synthesis of leading and lagging strands happens simultaneously
 Option B ✗ DNAP III add complementary nucleotides to both leading and lagging strands simultaneously, not in pair
 Option C ✓ Correct function of helicase
 Option D ✗ phosphodiester bond is formed between adjacent nucleotides by DNA ligase

Ans: **C [L1]** VJC 2015 H1 Prelim P1 Q10

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



With reference to the diagram above, 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** 1 and 2
- B** 3 and 4
- C** 2, 3 and 4
- D** 1, 3 and 4

SC: Diagram shows RNA looping, splicing (alternative splicing possible)

OR: Statement 1, 3 and 4 possible (even if not shown explicitly as qns ask for related process)
 Statement 2 is wrong (should be 5'GU and 3'AG)

Ans: **D [L3]** (HCI 2015 Prelim P1 Q15)

10. The coding region of a gene is 102 nucleotides long, including both the start and stop codons. Which of the following would be the most likely effect of a single nucleotide deletion at position 76 in the coding region?

- A Only the active site would be affected.
- B The entire amino acid sequence of the polypeptide would change.
- C There would be changes in only the first 25 amino acids.
- D There would be changes in only the last 8 amino acids.

SC: Application Translation coding by codon (3 nucleotides)

OR: Option A ✗ Insufficient info in qn to determine
Option B ✗ Insufficient info in qn to determine
Option C ✗ mutation is in position 76 which means the first 25 amino acid unaffected
Option D ✓ single nucleotide deletion at position 76 affects the last 8 amino acids.

Ans: **D [L2]** VJC 2015 H1 Prelim P1 Q11

11. An chromosomal inversion will

- A always cause a mutant phenotype.
- B interfere with translation of genes in the inverted region.
- C likely cause a mutant phenotype if the inversion fall within a gene.
- D halt transcription in the inverted region because the chromosome is now in the opposite arrangement.

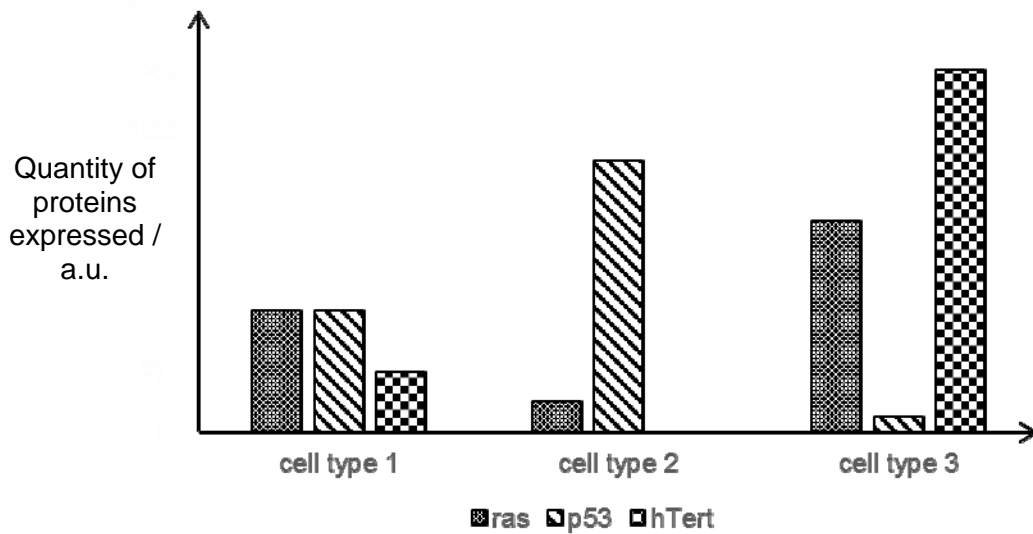
SC: Recall chromosomal aberration (inversion) in statement evaluation.

OR: Option A ✗ may not always be the case. e.g. region of inversion may be non-coding
Option B ✗ translation may not be affected
Option C ✓ true
Option D ✗ may not be the case.

Ans: **C [L2]** VJC 2015 H1 Prelim P1 Q12

12. 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 cell type was taken from a malignant tumour.



Which statement is true?

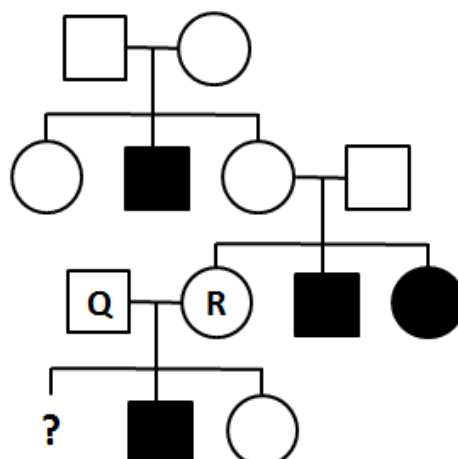
- A Cell type 1 is not from the malignant tumour since balanced expression of *ras* and *p53* halts cell cycle progression.
- B Activation of telomerase will result in cell type 2 gaining immortality and becoming cancerous.
- C Cell type 3 is obtained from the malignant tumour as the cells will divide uncontrollably.
- D Gain-of-function mutation of *hTert* in cell type 1 will result in malignant tumour formation.

SC: *ras* – oncogene, *p53* – Tumour suppressor gene, *hTert* – Telomerase gene (activated in cancer)

OR: Statement A false (insufficient info from data), Statement B false (no expression of telomerase), Statement D false (insufficient info from data to conclude gain-of-function mutation). State C true as it fulfils 3 conditions for cancer development (overexpression of *ras* oncogene, underexpression of *p53* tumour suppressor gene and high expression of telomerase).

Ans: C [L2] (HCI 2015 Prelim P1 Q17 modified)

13. Adducted thumb syndrome is a condition where affected individual will have malformation of the thumb and upper limbs. The figure below show a pedigree chart of a family with the history of adducted thumb syndrome.



If individual Q and R give birth to a son, what is the possibility that their son will be affected by the condition?

- A 0.125
- B 0.25
- C 0.50
- D 0.75

SC: Pedigree analysis + autosomal recessive inheritance. Q & R could be AA or Aa (only Aa x Aa will result in 25% chance of having affected offspring. Qn already stated son so need not factor 0.5 in the computation of probability)

OR: Option A ✗ (Qn context already stated son so do not need to factor $\frac{1}{2}$ into probability computation)
Option B ✓
Option C ✗
Option D ✗

Ans: **B [L2]** VJC 2015 H1 Prelim P1 Q15

- 14.** In the breeding season, male Anole lizards court females by bobbing their heads up and down while displaying a colorful 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 patches.

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

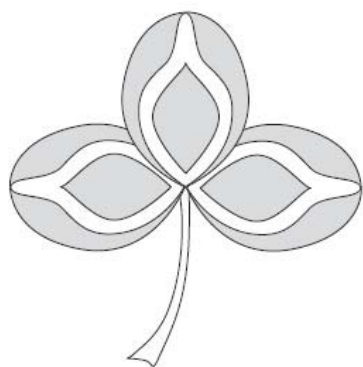
- A 25%
- B 50%
- C 75%
- D 100%

SC: Dihybrid inheritance application ($BbRR \times Bbrr \rightarrow 75\% B_Rr$)

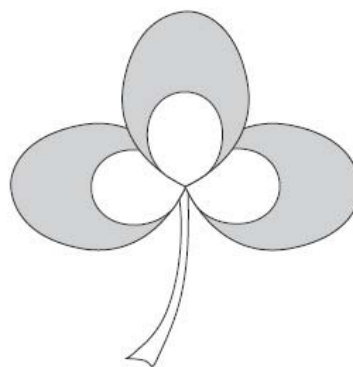
OR: Option A ✗ wrong (see SC above)
Option B ✗ wrong (see SC above)
Option C ✓ correct
Option D ✗ wrong (see SC above)

Ans: **C [L2]** HCI H1 2015 Prelim P1 Q15

15. 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.

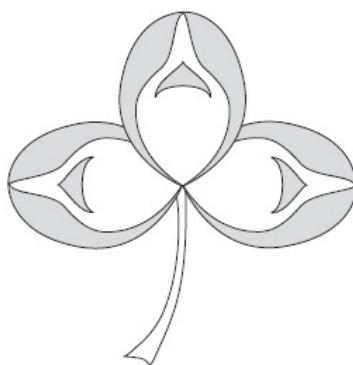


chevron pattern



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	dihybrid
C	> 2	codominance
D	> 2	dihybrid

SC: only 2 alleles (one for chevron and other for patch). Offspring shows mixed pattern (both expressed hence codominance)

OR: Accept A, Reject B (not dihybrid), C (not sufficient information provided to infer 3 or more alleles) and D (not dihybrid)

Ans: A

[L2] (HCI 2015 Prelim P1 Q19)

16. The colour of body fat in the rabbits is controlled by a single gene with 2 alleles in a dominant and recessive fashion. The allele G codes for white body fat while g codes for yellow body fat. However, when rabbits are fed on a xanthophyll (photosynthetic pigment) free diet, it results in homozygous recessive rabbits producing white body fat.

Which of the following options show the correct combination of parental genotypes and corresponding offspring's phenotypes under different conditions?

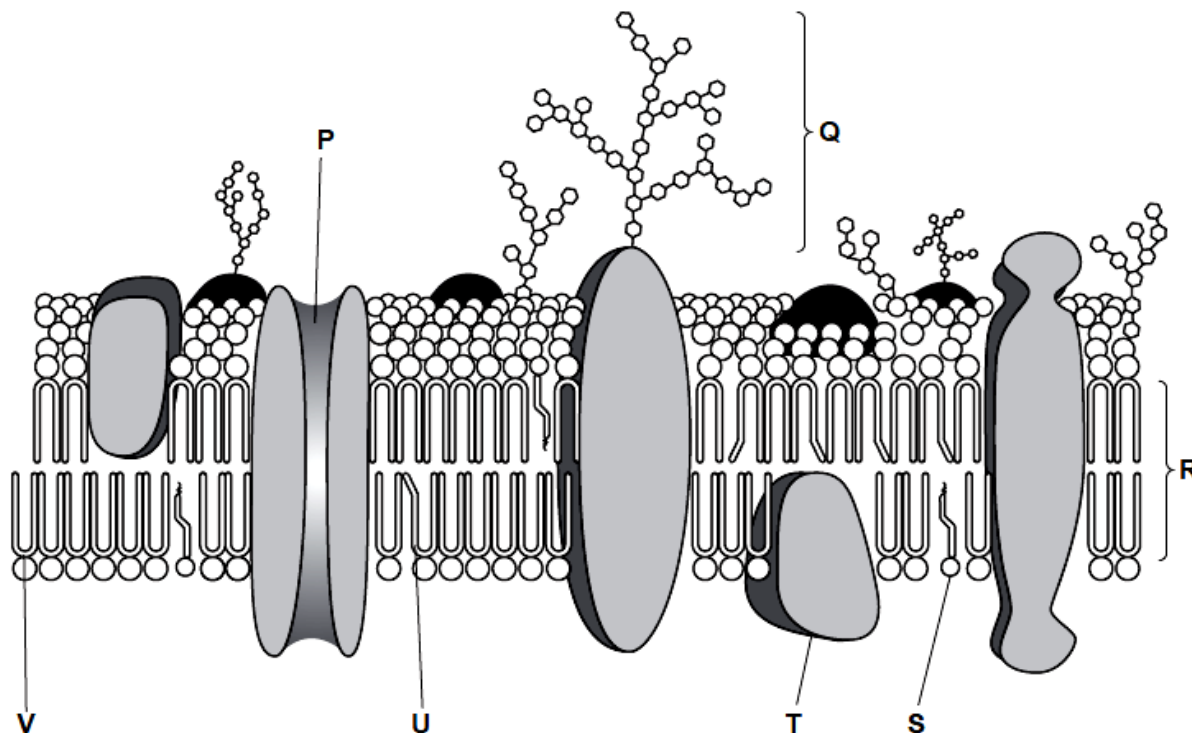
	Parental Genotype	Type of Diet	Offspring phenotype
A	Gg X gg	Xanthophyll free	All white
B	gg X Gg	Standard	3 yellow: 1 white
C	GG X gg	Xanthophyll free	1 white : 1 yellow
D	Gg X Gg	Standard	All white

SC: Recall chromosomal aberration (inversion) in statement evaluation.

OR: Option A ✓ Environmental influence will result in white body fat regardless of genotype
 Option B ✗ wrong phenotypic ratio
 Option C ✗ wrong phenotype
 Option D ✗ wrong phenotypic ratio

Ans: **A [L2]** VJC 2015 Prelim P1 Q18

17. 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**

SC: Application of understanding of fluid mosaic model of membrane. More fluid cell membrane have lower proportion of V (phospholipid with saturated fatty acid tails) and higher proportion of component U (phospholipid with unsaturated kinked fatty acid tails)

- OR:** Option A ✗ does not affect fluidity of membrane
 Option B ✗ does not affect fluidity of membrane
 Option C ✓ correct
 Option D ✗ wrong

Ans: **C [L2]** HCI H1 2015 Prelim P1 Q19

18. Which of the following statements about transport in the cell is incorrect?

- A** Active transport is the movement of substances across the cell membrane against a concentration gradient.
- B** Diffusion is the mechanism by which movement of hydrophobic particles through a cell membrane down a concentration gradient.
- C** Receptor mediated endocytosis involves the binding of the substance to specific receptors and their subsequent passive entry into the cell.
- D** Bulk transport is a process which requires energy.

SC: transport / false / transport / correct

OR: A True

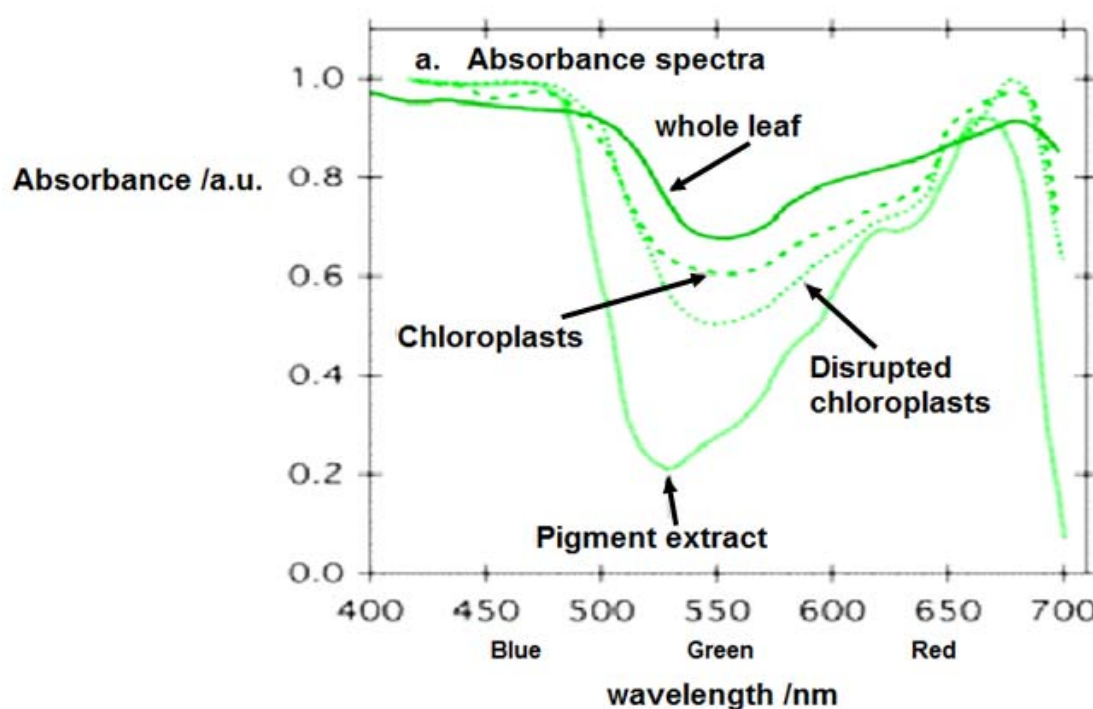
B True

C False (Receptor mediated endocytosis is an active process.)

D True

Ans: **C [L1]**

19. The figure shows the absorbance spectra of various components of a leaf.



What can be inferred from the data shown?

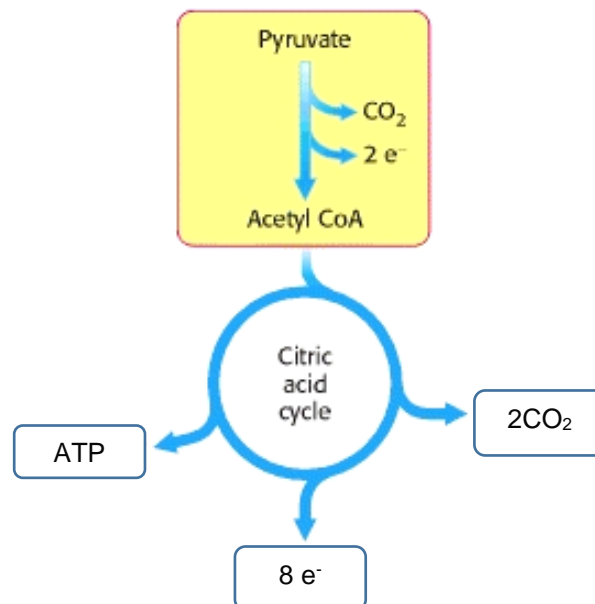
- A** Absorbance is highest in 650-700 nm in all leaf components due to light harvesting complexes.
- B** Whole leaf samples experience the least absorbance at 550 nm due to all green light being reflected.
- C** Disrupted chloroplast samples have higher absorbance compared to chloroplasts due to a larger surface area for light capture.
- D** Pigment extracts are the main agents of light harvesting due to the presence of carotenoids.

SC: inferred from data

- OR:**
- A** ✗ except in whole leaf where at 475nm, absorption is higher compared to 650-700nm.
 - B** ✗ not all green light is reflected, there is still absorption of 0.2 a.u.
 - C** ✗ Disrupted chloroplasts lack the organization compared to chlorophyll.
 - D** ✓ Carotenoids make up the main light harvesting components of the leaf.

Ans: D [L3]

- 20.** The figure below shows the part of the process of aerobic respiration.



Which of the following statements is true of the significance of acetyl CoA?

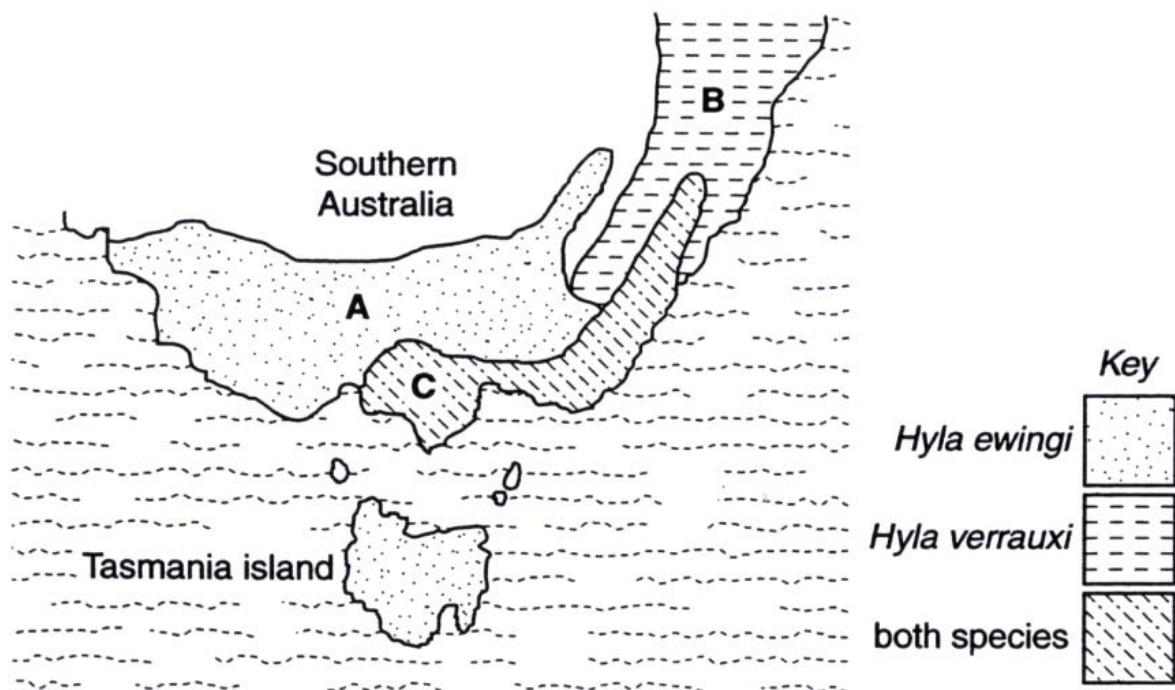
- A** Acetyl CoA is the product of the link reaction and is subsequently brought into the mitochondria to enter the Krebs cycle
- B** Acetyl CoA is the entry point into the metabolic pathway of both carbohydrates and fats.
- C** Acetyl CoA is an energised molecule combined with Oxaloacetate, to yield 4 molecules of citric acid per molecule of Glucose.
- D** Electrons released in the formation of Acetyl CoA are used in the production of NADPH.

SC: true significance / acetyl CoA

- OR:**
- A** ✗ link reaction occurs in the mitochondrial matrix.
 - B** ✓ lipid metabolism enters here.
 - C** ✗ only 2 molecules of citric acid are produced for every 1 molecule of glucose.
 - D** ✗ electrons released is used in the production of NADH not NADPH.

Ans: B [L2]

21. Two closely related species of frog, *Hyla ewingi* and *Hyla verrauxi* live in South Australia. The figure below shows the distribution of the tree frogs in Southern Australia.



Hyla ewingi and *Hyla verrauxi* are two closely related species of tree frogs from southern Australia. Research from breeding studies and DNA sequence data has shown that they have weak genetic incompatibility.

Male frogs attract females of the same species for mating by their pulsing call. The pulse rate of the male calls of the two species is almost identical. However, when both species coexist within the same region, the calls of *H. ewingi* are quite different than those of *H. verrauxi*.

Which of the following can be correctly inferred from the data given?

- A Complete speciation has taken place between the two groups of frogs.
- B Allopatric speciation was probably the evolutionary mechanism at work.
- C Convergent evolution has seen the frogs in Tasmania similar to those in region A in Australia.
- D Sympatric speciation was probably the evolutionary mechanism at work.

SC:

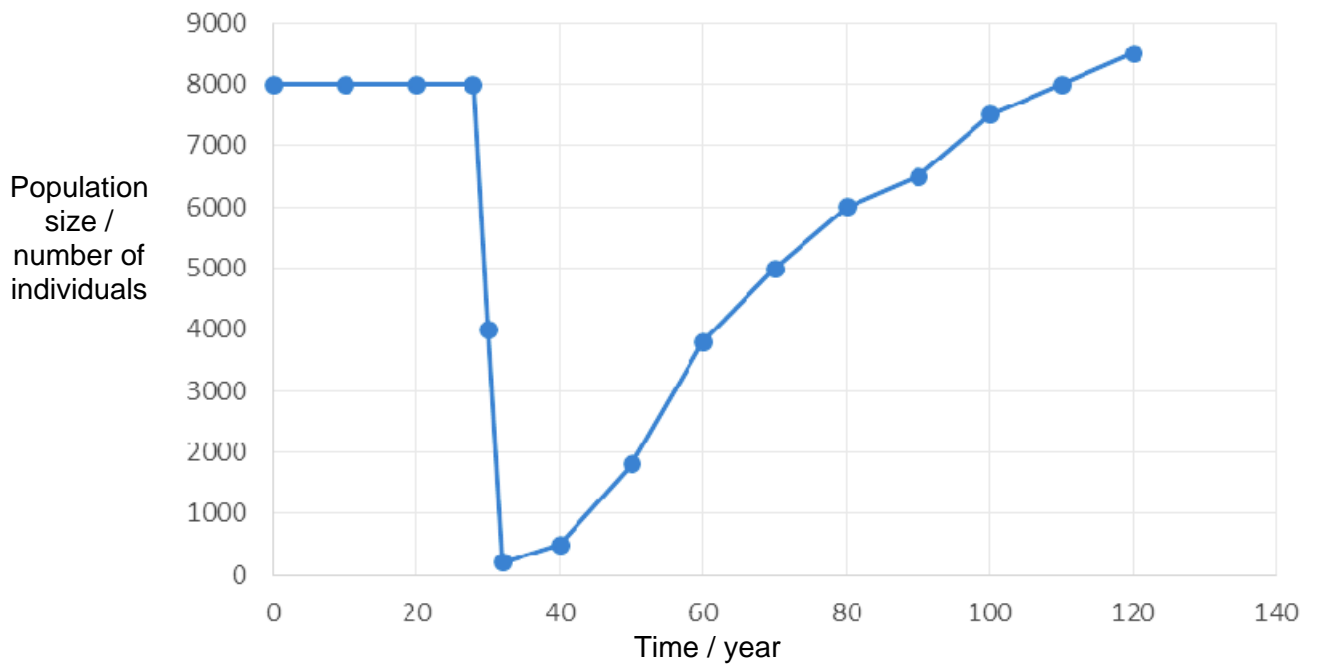
1. P2L1 weak genetic incompatibility – ie genetically similar
2. P3L1 Male attract females for mating – ie are not reproductively isolated- same species
3. P3L1 different behaviours- behavioural isolation beginning but not led yet to reproductive isolation.
4. P3L2 coexist in same region, no geographical isolation- Sympatric speciation occurring over time.

-correctly inferred / data given

- OR:**
- A ✗ reasons from point 2.
 - B ✗ reasons from point 4.
 - C ✗ plate tectonics in biogeography would explain *H. ewingi* present in both regions not convergent evolution. Besides they are exactly the same species so cannot be Convergent evolution.
 - D ✓ reasons from point 4.

Ans: D [L2]

22. The figure shows the population of a group of organisms in a fixed region over time.



The following statements are derived from the data shown.

- i. Bottleneck event has taken place Year 30 to 35
- ii. Genetic variation has been fully restored by Year 110
- iii. Allele frequency steadily increases due to genetic drift
- iv. Founder effect has taken place from Year 28 onward

Which statements can be concluded as true?

- A i only
- B ii only
- C i, ii & iii only
- D i, iii & iv only

SC: 1. P1L1 Populatio .. fixed region ie no founder effect

OR: 2. i ✓ Bottle neck possible drastic reduction in population

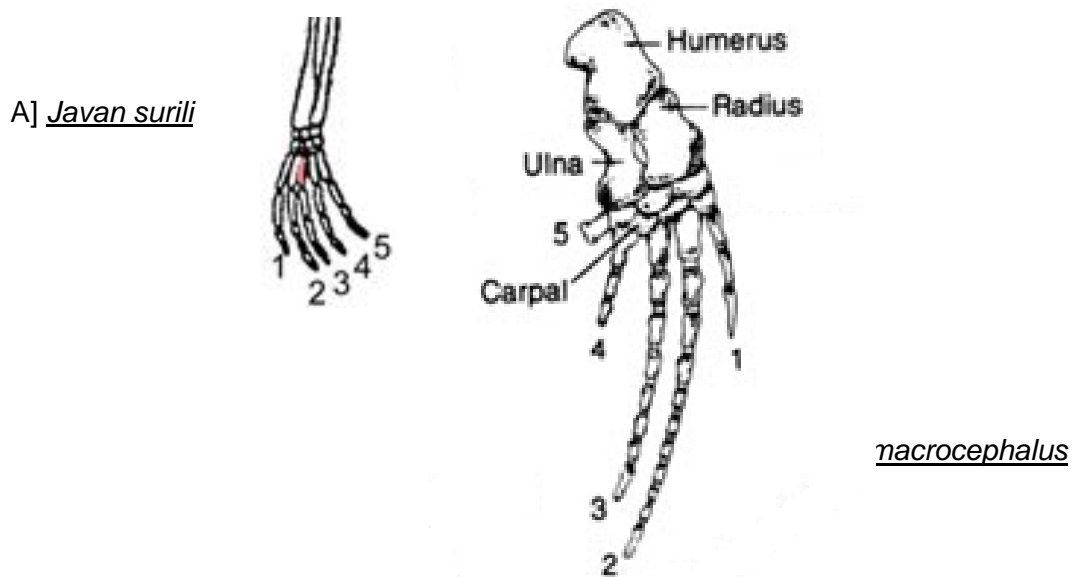
3. ii ✗ genetic variation is reduced after bottleneck and is only increased by mutation over time but would not have been regained by year 150.

4. iii ✗ Not conclusive from the table.

5. iv ✗ Founder Effect is not considered in the original population see point 1.

Ans: A [L2 high]

23. The following figure shows the anatomy of the left front appendages of the two vertebrates.



Which one of the following correctly describes the type of structures seen and their evolutionary connection?

	Type of structures	Ancestry	Type of evolution
A	Homologous	Different ancestor	Convergent Evolution
B	Homologous	Common ancestor	Divergent Evolution
C	Analogous	Different ancestor	Convergent Evolution
D	Analogous	Common ancestor	Divergent Evolution

SC: correct type structure / evo connection

OR: Homologous (same pentadactyle plan) / divergent evo / common ancestor

A * same ancestor / not convergent

B ✓ correct.

C * not analogous / same ancestor / not convergent.

D * not analogous / not divergent evo.

Ans: B [L2]

24. *lacZ* gene is a genetic marker found in the plasmid which can be used in genetic engineering.

What is the function of *lacZ* gene in a cloning vector?

A Express *lac* repressor

B Distinguish between introns and exons

C Break down lactose to galactose and glucose

D Screen for cells with the recombinant plasmid

SC: factual recall

OR: Statement A wrong, B (wrong) and C (true but not align to qn context. Also, the gene does not do the breakdown of lactose, it is the enzyme that is encoded for). Only Statement D relevant. Accept option D.

Ans: D [L1] (TJC 2015 Prelim P1 Q33)

- 25.** 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?

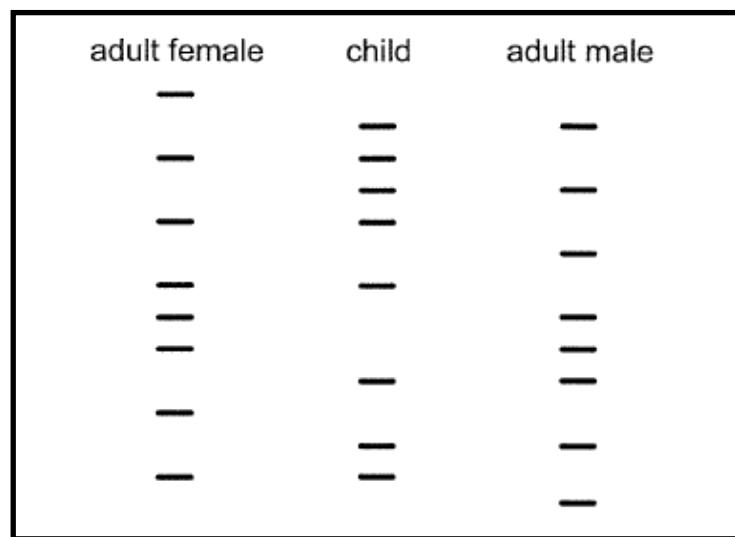
	precision	yield
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

SC: Application of understanding the three phases of PCR

OR: increase annealing temperature increase specificity of primer annealing → increase in precision, increasing extension phase → increase PCR product [yield]. Accept Option D

Ans: **D [L2]** (HCI 2015 H1 Prelim P1 Q27)

- 26.** The diagram shows the results of a DNA analysis for victims of an airplane crash, carried out by gel electrophoresis. The DNA of three individuals was profiled.



What is the most likely conclusion from these results?

- A** The child cannot be related to either the male or female
- B** The female cannot be the child's mother
- C** The male cannot be the child's father
- D** The male and female could be the child's parents

SC: Application of gel electrophoresis analysis

OR: The child have matching bands with either female or male, hence must be related → parents

Ans: **D [L2]** (HCI 2015 H1 Prelim P1 Q26)

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

Which of the following statements correctly describe 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 social stigmatisation of genetically predisposed individuals

- A** 1 and 2
B 3 and 4
C 1, 2 and 3
D All of the above

SC: For HGP genetic testing, all are unintended.

OR: Statement 1, 2, 3 and 4 are unintended consequences. Accept Option C.

Ans: D [L1]

28. Which of the following shows the correct developmental potency of the following stem cells.

	Haematopoietic stem cells	Zygotic stem cells	Embryonic stem cells	Neural stem cells
A	Multipotent	Pluripotent	Totipotent	Unipotent
B	Multipotent	Totipotent	Pluripotent	Unipotent
C	Multipotent	Pluripotent	Totipotent	Multipotent
D	Multipotent	Totipotent	Pluripotent	Multipotent

SC: Stem cells' developmental potency

OR:

- HSCs & NSCs are multipotent
- Zygotic stem cells are totipotent
- ESCs are pluripotent

Ans: D [L1] (novel)

29. Cows can be genetically modified (GM) by inserting growth hormone genes. Which of the following are valid concerns about GM cows that produce more meat per mass of feed given?

- 1 Introduction of foreign gene may result in production of secondary metabolites which may be toxic to humans who consume them.
- 2 Antibiotic resistance genes in vectors used in GM cows may be passed to the cows, causing them to become resistant to antibiotics.
- 3 GM cows may escape and out-compete the wild populations of bovine species due to their higher rate of growth.
- 4 The meat produced by GM cows is of lower quality than non-GM cows.
- 5 GM cows may pass the foreign gene to their offspring.

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

SC: GMO concerns

OR:

- Statement 1: Possible.
- Statement 2: Wrong, transfer of antibiotic resistance genes across cows unlikely
- Statement 3: Possible
- Statement 4: Unlikely.
- Statement 5: Unlikely, genetic modification not done on germline cells according to ethical guidelines.

Ans: A [L1] ('15 SAJC/H1 P1/Q30)

30. 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.

SC: GMO animals

OR:

- A: Correct.
- B: Does not solve the demand for food.
- C: Does not solve the demand for food.
- D: Does not solve the demand for food.

Ans: A [L1] ('15 HCI/P1/Q40)

END OF PAPER