Protein synthesis

Mark Scheme 5

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Nucleic acids and protein synthesis
Sub Topic	Protein synthesis
Booklet	Theory
Paper Type	Mark Scheme 5

Time Allowed : **68 minutes**

Score : **/ 56**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** 1. low oxygen (in water) results in anaerobic respiration **;**
2. (anaerobic respiration) produces alcohol **;**
3. rice tolerant to alcohol **;**
4. (because rice has) high levels of, alcohol dehydrogenase / enzyme that breaks down alcohol **;**
5. presence of, aerenchyma / described **;**
6. allows, oxygen / air, to reach roots (from aerial tissues) **;** [3 max]

(b) **(i)** 1. (immersion in water) stimulates production of ethene **;**
2. (concentration of) ethene produced increased with time (after submergence) **;**
3. very little difference in ethene production between T65 and C9285 **;**
4. use of figures **;** 2 values of ethene **plus** 2 values of time for **either** T65 **or** C9285 [2 max]

(ii) 1. in T65 ethene does not affect internode elongation **but** in C9285 ethene promotes internode elongation **;**
2. in C9285, greater concentrations of ethene cause greater elongation **;**
3. use of comparative figures to support mark point 1 **or** mark point 2 **;** *both units at least once* [2 max]

(c) 1. *SK* genes present in C9285 / *SK* genes not present in T65 **;**
2. **increased** production of GA in C9285 / little or no increased production of GA in T65 **;**
3. GA stimulates, stem elongation / AW **;**
4. AVP **;** e.g. T65 has no receptors for ethene [3 max]

(d) **(i)** *SK2* more important **; ora**
O. nivara has mutated *SK2* and does not have deepwater response
or
O. glumaepatula has *SK2* but not *SK1* and does have deepwater response **;** [2]

(ii) 1. (addition / insertion), of a, base / nucleotide, to DNA / to a gene **;**
2. changes a, sequence of three bases / triplet / codon **;** *ignore ref. to frame shift*
3. (triplet) no longer codes for an amino acid **;** [2 max]

(iii) 1. breed deepwater variety with (high-yielding) non-deepwater variety **;**
2. identify / select, offspring with **both** deepwater response and high yield **;**
3. breed selected offspring (with **both** deepwater response and high yield) **;**
4. continue for many generations **;** [3 max]

[Total: 17]

2 **(a)** 1. (amino acid) code is three, bases / nucleotides ; **A** triplet code
2. (gene) mutation ; **R** chromosome mutation
3. base / nucleotide, substitution / addition / deletion
4. addition / deletion, has large effect (on amino acid sequence) ;
5. frame shift ;
6. completely new code after mutation / alters every 3 base sequence which follows ;
7. substitution may have little or no effect / silent mutation ;
8. different triplet but same amino acid / new amino acid in non-functional part of protein ;
9. substitution may have big effect (on amino acid sequence) ;
10. could produce 'stop' codon ;
11. sickle cell anaemia / PKU / cystic fibrosis ;
12. reference to transcription or translation in correct context ; **A** description [8 max]

(b) 13. (haemophilia) allele on X chromosome ; **A** gene
14. sex-linked ;
15. (haemophilia) allele recessive ;
16. man, homogametic / has one X chromosome ;
17. Y chromosome does not have blood clotting gene ;
18. only daughter(s) get his X chromosome ;
19. daughter(s) carrier(s) of (haemophilia) allele ;
20. grandson(s) 50% chance of having, (haemophilia) allele / haemophilia ;
21. granddaughter(s) 50% chance of carrying, (haemophilia) allele ;

allow following marks from diagram

22. correct symbols ; e.g. X^H and X^h explained
23. man's genotype ; e.g. X^hY *ignore partner's genotype*
24. F1 (daughter's) genotype ; e.g. X^HX^h *ignore her partner's genotype*
25. F2 (grandson's) genotypes ; e.g. X^hY X^HY *both required*
26. F2 (granddaughter's) genotypes ; e.g. X^HX^H X^HX^h *both required* **or** X^hX^h X^HX^h [7 max]

[Total: 15]

3 **(a) (i)** **A** phospholipid **;** (1)
B protein **;** *ignore protein descriptions* **R** glycoprotein **R** lipoprotein (1) [2]

(ii) polar / hydrophilic, head / group **;**
attracted to / AW, water / aqueous environment **; A** water-loving
ref. hydrogen bonding (polar head to water) **;**

non-polar / hydrophobic / hydrocarbon / fatty acid, tails / chains / groups **;**
repelled by / away from, water / aqueous environment **;** AW **R** water-hating [max 3]

(b) **C** *any one of*
(channel) allows, ions / water / polar molecules / water-soluble molecules / hydrophilic molecules, to, pass through membrane / enter cell / leave cell **;**
R transport, without qualification e.g. across, through
facilitated diffusion **;**
active transport **;** (max 1)

D *any one relevant e.g.*
cellular recognition
cell identification
antigen
cell signalling
receptor
binding site
ref to hydrogen bonding with water / forms bond with water to stabilise membrane
cell adhesion (max 1) [2]

(c) 1764 **;;**

if correct working (588 × 3) is shown, but no answer or incorrect answer, award one mark [2]

[Total: 9]

4 **(a)** *do not credit marking points out of sequence*
prophase 1

1 idea of condensation of chromosomes ;

2 homologous chromosomes pair up / bivalent formed ;

metaphase 1

3 homologous chromosomes / bivalents, line up on equator ;

4 of spindle ;

5 by centromeres ;

6 independent assortment / described ;

7 chiasmata / described ;

8 crossing over / described ;

anaphase 1

9 chromosomes move to poles ;

10 homologous chromosomes / bivalents, separate ;

11 pulled by microtubules ;

12 reduction division ;

metaphase 2

13 chromosomes line up on equator ;

14 o spindle ;

anaphase 2

15 centromere divide ;

16 chromati move to poles ;

17 pulle by microtubules ;

18 ref. haploid number ;

allow 4 ***or*** *14*
allow 11 ***or*** *17* [9 max]

(b) 19 change in, base / nucleotide, sequence (in DNA) **;**

20 during DNA replication **;**

21 detail of change **;** e.g. base, substitution / addition / deletion

22 frame shifts / AW **;**

23 different / new, <u>allele</u> **;**

24 random / spontaneous **;**

25 mutagens **;**

26 ionising radiation **;**

27UV radiation / mustard gas **;**

[6 max]

[Total: 15]