
BIOLOGY

9700/04

Paper 4 A Level Structured Questions

For Examination from 2016

SPECIMEN MARK SCHEME

2 hours

MAXIMUM MARK: 100

This document consists of **10** printed pages.

Mark scheme abbreviations:

| | |
|-------------------------|---|
| ; | separates marking points |
| / | alternative answers for the same point |
| R | reject |
| A | accept (for answers correctly cued by the question, or by extra guidance) |
| AW | alternative wording (where responses vary more than usual) |
| <u>underline</u> | actual word given must be used by candidate (grammatical variants excepted) |
| max | maximum number of marks that can be given |
| ora | or reverse argument |
| mp | marking point (with relevant number) |
| ecf | error carried forward |
| I | ignore |
| AVP | alternative valid point (examples given as guidance) |

Numbers against mark points are for examiner reference only; they do not reflect relative importance of answers or a required sequence of answers.

1 (a) corals

(cells) have no chloroplasts ;
(cells) have no, cell walls / large vacuoles ;
are heterotrophic / not autotrophic / not photosynthetic ;

[max 2]

(b) biotic and abiotic components or living and non-living components ; correct ref. to interaction ;
[2]

(c) (i) Indian Ocean = 22(%)
Pacific Ocean = 9(%) ;
both correct for 1 mark

[1]

- (ii)**
1. named marine pollutant ; e.g. oil / sewage
 2. example of climate change ; e.g. sea level rising / change in sea temperature / decrease in oxygen concentration of sea
 3. (increasing carbon dioxide) decrease in pH of sea ;
 4. intensive fishing ;
 5. tourism qualified ;
 6. removal of parts of reef ;
 7. reclaiming land ;

[max 3]

[Total:8]

- 2 (a) (i) substrate level ;
protein synthesis / DNA replication / glycogenesis / polymerisation ;
active transport / movement of chromosomes / sliding filaments / movement of vesicles /
AW ; [3]
- (ii) water ; [1]
- (iii) ATP, synthase / synthetase ; **R** ATPase [1]
- (b) (i) (converted to) glycogen / lipid ;
(used in) glycolysis / respiration ; [max 1]
- (ii) *anaerobic*
less ATP / only 2 ATP ;
per mol glucose ;
lactate still contains energy / only glycolysis involved
/ stages other than glycolysis not involved ;
not sustainable / cannot go on indefinitely / AW ; [max 2]
- (iii)
- | process | precise location |
|---------------------------|--|
| glycolysis | cytoplasm / cytosol ; |
| link reaction | mitochondrial matrix ; |
| Krebs cycle | mitochondrial matrix ; |
| oxidative phosphorylation | inner mitochondrial membrane / cristae ; |
- [4]
- (iv) cannot pass through phospholipid bilayer ;
too big to fit through (glucose's) protein channel ;
no specific transport protein ;
AVP ; e.g. used up as soon as it is made [max 2]
- (v) oxygen debt ; [1]

[Total: 15]

- 3 (a) (i) 17.9 ;;
accept $\frac{125}{700} (\times 100)$ or 17.8 for one mark [2]
- (ii) *fluid can pass through glomerular capillaries because fenestrations in capillary endothelium ; A hole / pores / gaps basement membrane acts as a filter ; no substances > 68 000 MM can get through ; no cells can get through ;* [max 2]
- (b) produce ATP / provide energy ;
for active transport of Na⁺ ;
out (of cell) ; [max 2]
- (c) *mark first two answers*
any named ion / mineral ions ;
vitamins ;
amino acids ;
glucose ;
some urea ; [max 2]
- [Total: 8]

- 4 (a) (guard cell) thicker inner / unevenly thickened, cell wall ; ora
ref. to differences in, size / shape ; [max 1]
- (b) (i) (receptors) on plasma / cell surface, membrane (of guard cells) ; [1]
(ii) K^+ / potassium ; [1]
(iii) (guard cell has) higher water potential than epidermal cell ; ora [1]
(iv) decrease ; [1]
- (c) (i) provides carbon dioxide ; [1]
(ii) 0.1 ;
% per minute ; **R plural** [2]
(iii) 0–10 min / initially, rate for **B** is faster than rate for **A** ;
10–20 min / AW, rate decreases for **B** and not for **A** / rate decreases more for **B** ;
paired figs ; **A & B % at same time (minutes)** [max 2]
(iv) no, photosynthesis / light dependent reaction ;
oxygen used up in respiration ; [2]
(v) temperature ; [1]
- (d) **X** = reduced NADP ;
Y = ATP ; [2]
- [Total: 15]

- 5 (a) *heterozygous*
two different alleles of a gene / different allele pair for a gene / AW ;
produces gametes with different genotypes ; (*max 1*)
- genotype*
alleles present in an organism / particular alleles of a gene / genetic constitution / AW ;
[max 2]

- (b) *parental genotypes*
AaDd × AaDd ;
- gametes*
AD Ad aD ad × AD Ad aD ad ;
- two marks for correct Punnett square ;; *deduct one mark for each mistake*
(all 4) phenotypes linked correctly to genotypes ;
(probability of yellow offspring) 3 out of 16 **or** 0.19 **or** 19% ; [6]

[Total: 8]

6 (a) *any five from:*

1. allopatric speciation ;
2. fish populations isolated ;
3. geographical / physical / land, barrier ;
4. no, breeding / allele flow / gene flow, between populations ;
5. mutations occur ;
6. different selection pressures / different (environmental) conditions ;
7. advantageous alleles selected for / advantageous alleles passed on ;
8. change in, allele frequency / gene pool ;
9. (can result in) different chromosome numbers ;
10. genetic drift ;
11. ultimately, reproductively isolated / cannot interbreed ;

[max 5]

(b) *any three from:*

1. numbers of all species increase initially ;
2. due to more, breeding space / food ;
3. competition between (four) species ;
4. (possible) reduction in numbers within, some / all, species ;
5. not all species (may) survive ;
6. different species, restricted to different areas / occupy different niches ;
7. interbreeding / hybridisation ;
8. AVP ; e.g. ref. new selection pressure

[max 3]

[Total: 8]

7 (a) *any five from:*

1. (touching hairs causes), action potential / depolarisation ;
2. auxin increase triggered in hinge cells ;
3. H⁺ / hydrogen ions, pumped into cell walls ;
4. calcium pectate 'glue' in cell wall dissolved ;
5. Ca²⁺ ions enter hinge cell ;
6. water follows by osmosis ;
7. hinge / midrib, cells expand ;
8. trap lobes, flip from convex to concave / change in elastic tension ;

[max. 5]

(b) (i) random sampling using frame quadrats ;

[1]

(ii) Simpson's index of diversity ;

[1]

(iii) Spearman's rank correlation coefficient ;

[1]

[Total: 8]

- 8 (a) (i) general description of the trend ;
 steepest / fastest, increase between 1996 and 1999 ;
 comparative data quote either for Bt cotton or HT cotton ;
 e.g. Bt cotton increased from 16% (in 1996) to 75% in 2013
or
 HT cotton increased from 2% (in 1996) to 82% in 2013
 ref. most cotton is modified to be both Bt and HT ; [max 3]
- (ii) *Agrobacterium tumefaciens* / Ti plasmid / pGreen plasmid ; [1]
- (iii) to check whether gene transfer was successful ;
 to see which parts of plant expressed new genes ;
 GUS marker easy to, use / track / see (compared to antibiotic resistance markers) ; [max 2]
- (b) (i) number (of glyphosate-resistant weed species) only increased after 1995 / 1996 ;
 this was when, GM crops resistant to herbicide / HT crops, were introduced ; [2]
- (ii) no triazine-resistance genes existed in crops but weeds developed triazine resistance ;
 idea that triazine resistance in weeds pre-dates, gene technology / genetic modification ; [max 1]
- (iii) spontaneous / random, mutation ;
 weeds without, allele / mutation, die ; ora
 when / so long as, (named) herbicide (still) applied ;
 new allele / mutation, selected for / gives selective advantage ; ora
 survivors, breed / reproduce / pass on, allele / mutation ; ora
 frequency of, new allele / mutation, increases ; [max 4]
- (c) *any suitable suggestions, such as:*
1. the damage done by the insect pests surveyed ;
 2. the number of reports of resistance for each species ;
 3. the proportion of populations with the highest percentage of resistant individuals ;
 4. the effect on the crops concerned of pest resistance at the levels given (<1%, etc.) ;
 e.g. the losses in yield
 5. the geographical spread of the insect pest species that show resistance ;
 6. AVP ;
 7. AVP ; [max 2]

[Total: 15]

- 9 (a)
1. glucagon binds to receptors in cell surface membrane (of liver cell) ;
 2. receptor changes conformation ;
 3. G-protein activated ;
 4. adenylate cyclase activated ;
 5. ATP converted to cyclic AMP / cyclic AMP made ;
 6. (cyclic AMP is) second messenger ;
 7. (cyclic AMP) activates kinase protein ;
 8. ref. enzyme cascade ;
 9. ref. phosphorylase enzyme(s) / glycogen phosphorylase ;
 10. glycogen broken to glucose ;
 11. glucose, diffuses / passes out, of (liver) cell (into the blood) ;
 12. through GLUT2 transporter proteins ;
 13. AVP ; e.g. ref. to stimulating gluconeogenesis

[max 9]

(b) method

1. stick dipped into urine ;
2. glucose oxidase (on stick) reacts with glucose (in urine) ;
3. forms gluconolactone ;
4. and hydrogen peroxide ;
5. (hydrogen peroxide) reacts with chromogen (on stick) ;
6. catalysed by peroxidase enzyme ;
7. colour produced matched against chart ; (*max 4*)

advantages

8. electronic biosensor does not involve colour matching ; ora
A ref to subjectivity of results from dip sticks
9. gives a specific reading, not a range of values (if not an exact match to a colour) ; ora
10. biosensor gives a digital reading so no need to interpret a colour chart ;
11. biosensor can be re-used again ; ora (*max 3*)

[max 6]

[Total: 15]

- 10 (a)**
1. regulatory gene codes for repressor protein ;
 2. (repressor protein) binds to operator region ;
 3. (repressor protein) blocks promoter region ;
 4. lactose binds to repressor protein which changes shape ;
 5. (repressor protein with bound lactose) breaks away from operator region ;
 6. promoter region now unblocked, so RNA polymerase binds to promoter region ;
 7. structural genes transcribed ;
 8. and translated ;
 9. enzymes formed ;
 10. ref. lactose permease and uptake of lactose from medium ;
 11. ref. β -galactosidase and breakdown of lactose ;
 12. into, glucose / galactose ;
- [max 9]

- (b)**
1. DELLA proteins inhibit germination ;
 2. seed absorbs water ;
 3. stimulates production of gibberellin ;
 4. by embryo ;
 5. gibberellin causes breakdown of DELLA proteins ;
 6. leads to transcription of mRNA coding for amylase ;
 7. in aleurone layer ;
 8. (amylase) hydrolyses starch to maltose ;
 9. ref. maltose converted to glucose ;
 10. glucose respired by embryo during germination ;
- [max 6]

[Total: 15]