

Mark Scheme (Results)

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Pearson Edexcel GCE
In Biology A Salters Nuffield (8BN0)
Paper 02: Development, Plants and the Environment

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional guidance	Mark
1(a)	An answer that includes the following: • labelled cell membrane drawn inside the cell wall (1) • labelled mesosome drawn as an infolding of the cell membrane but not connected to the cell wall (1) • labelled plasmid drawn as a circle or continuous shape, smaller than the DNA chromosome (1)		**(3)**

Question Number	Answer	Mark
1(b)	The only correct answer is – **C** smaller than in eukaryotic cells **A** is incorrect because ribosomes are present in prokaryotic cells **B** is incorrect because ribosomes are smaller in prokaryotic cells **D** is incorrect because ribosomes are smaller in prokaryotic cells	**(1)**

Question Number	Answer	Mark
1(c)	The only correct answer is – D outside the cell wall **A** is incorrect because the capsule is not between the cell membrane and the cell wall **B** is incorrect because the capsule is not in the cytoplasm **C** is incorrect because the capsule is not inside the cell wall	**(1)**

Question Number	Answer	Mark
1(d)	The only correct answer is – **B** circular with no nuclear membrane **A** is incorrect because bacterial DNA is not surrounded by a nuclear membrane **C** is incorrect because bacterial DNA is not linear **D** is incorrect because bacterial DNA is not linear	**(1)**

Question Number	Answer	Additional guidance	Mark
2(a)(i)	An answer that includes the following: • a diagram showing a pair of homologous chromosomes with a crossover between two chromatids (1) • crossing of non-sister chromatids (1)	ALLOW correct products of crossover.	**(2)**

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	An explanation that makes reference to the following: Crossing over • chromatids are produced with different combinations of alleles (1) • for example { Ab/aB } (1) Independent Assortment • different combinations of chromosomes (1 and 2) are produced (1) • therefore the alleles for A and B could be in the same gamete as C or c (1)		**(4)**

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that makes reference to the following: • crossovers cannot form between (some sections of) the X and Y chromosome (1) • because { they are not homologous chromosomes / the Y chromosome is shorter / there are alleles on the X chromosome that are not on the Y chromosome } (1)	ALLOW crossovers unlikely to form between the X and Y chromosome ALLOW reference to difference in size of the X and Y chromosomes	**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)(i)	• centriole	ALLOW centrosome	**(1)**

Question Number	Answer	Mark
3(a)(ii)	The only correct answer is – **D** spindle organisation **A** is incorrect because the centriole is not involved in lipid synthesis **B** is incorrect because the centriole is not involved in protein synthesis **C** is incorrect because the centriole is not involved in ribosome production	**(1)**

Question Number	Answer	Additional guidance	Mark
3(b)	An explanation that makes reference to four of the following: Adding hydrochloric acid • breaks down middle lamella (1) • allowing cells to be separated / produce a thin layer (of cells)(1) • to allow light to pass through (1) Adding stain • makes the chromosomes visible (1) • so that stages of mitosis can be identified (1)	ALLOW one cell can be observed at a time	**(4)**

Question Number	Answer	Additional guidance	Mark
3(c)	An explanation that makes reference to the following • produced between (adjacent) new cells (in cell plate) (1) • because the middle lamella holds cell walls together (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
4(a)	A description that makes reference to two of the following: • the membrane of the acrosome fuses with the (plasma) membrane (of the sperm cell) (1) • releasing enzymes (from the acrosome) (1) • by exocytosis (1)	ALLOW acrosin	**(2)**

Question Number	Answer	Mark
4(b)	The only correct answer is – **A** 45000 μm^2 **B** is incorrect because the diameter was used instead of the radius **C** is incorrect because 4πr was calculated before squaring **D** is incorrect because 4π × diameter was calculated before squaring	**(1)**

Question Number	Answer	Additional guidance	Mark
4(c)(i)	• correct percentage selected (1) • correct calculation of number of eggs rounded up to whole number of eggs (1)	Example of calculation 33% 0.33 x 15 = 4.95 = 5 (eggs) One mark for 4.95 Correct answer without working gains full marks	**(2)**

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	An answer that makes reference to the following: • as sperm cell concentration increases so does the risk of polyspermy (1)	ALLOW positive correlation	**(1)**

Question Number	Indicative content
4(c)(iii)	Answers will be credited according to candidate's knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • {removing the zona pellucida causes an increase in polyspermy • because it prevents a physical barrier being formed • the effect is increased at higher sperm cell concentrations • because more sperm cells reach the (egg cell) membrane at the same time. • there is an increased concentration of sperm around the egg in IVF • due to shorter distance that the sperm have to swim / fewer sperm die on the way to the egg • even with zona pellucida intact there are some incidences of polyspermy • there is a delay while the cortical reaction takes place • physical damage to zona pellucida can prevent effectiveness of cortical reaction

Level	Marks		Additional Guidance
0	0	No awardable content	
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.	Damage to zona pellucida increases risk of polyspermy OR increased number of sperm increase risk of polyspermy
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.	Reference made to data showing polyspermy increases with increase in sperm 'concentration' OR increases when zona pellucida removed. Link made to either lack of hardening of zona pellucida or increased probability to more than one sperm entering if there are more of them.
3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Reference to data on both sperm 'concentration' and presence of zona pellucida, linked to cortical reaction which would otherwise prevent polyspermy. Answer links all the data and makes reference to reasons why IVF could result in increased risk of polyspermy.

Question Number	Answer	Mark
5(a)	The only correct answer is – C Eurasian badger and South Asian badger as they belong to the same species **A** is incorrect because the Asian badger and the South Asian badger are unable to produce fertile offspring **B** is incorrect because the Eurasian badger and Asian badger are unable to produce fertile offspring **D** is incorrect because the Japanese badger and the south Asian badger are unable to produce fertile offspring	**(1)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An explanation that makes reference to the following: • comparing similarities and differences in { DNA / proteins } (1) • comparison of { nucleotide sequences / amino acid sequences } (1) • the greater the number of differences, the more likely they are to be reproductively isolated (1)	ALLOW RNA ALLOW If sequences seen on one side but not seen on the other.	**(3)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	A description that makes reference to the following: • mutations result in production of new alleles (1) • selection pressures cause the { alleles / mutations } to be advantageous (1) • more individuals with the advantageous alleles survive and reproduce (1) • after time, the population would not be able to reproduce with other badger species to produce fertile offspring (1)	ALLOW different alleles	**(4)**

Question Number	Answer	Additional guidance	Mark
5(c)	An explanation that makes reference to the following: • Hardy-Weinberg equation shows the allele frequency in a population (1) • if natural selection is occurring there would be a change in allele frequency over time (1)	ALLOW reference to change in number of heterozygotes	**(2)**

Question Number	Answer	Additional guidance	Mark
6(a)	A description that makes reference to the following: • (zygote) divides by mitosis (1) • producing genetically identical { cells / embryos } (1)		**(2)**

Question Number	Answer	Mark
6(b)	The only correct answer is – D multiple alleles at multiple loci **B** is incorrect because polygenic traits involve more than one allele **A** is incorrect because polygenic traits involve more than one locus **C** is incorrect because polygenic traits involve more than one locus	**(1)**

Question Number	Answer	Additional guidance	Mark
6(c)	An explanation that makes reference to four of the following: • monozygotic twins show higher correlation (than dizygotic twins at all ages) (1) • therefore genetic factors have a greater effect (1) • because monozygotic twins have identical alleles (for body mass) (1) • monozygotic twins show less than 100% correlation (1) • therefore environmental factors affect body mass (1)	ALLOW monozygotic twins have more alleles in common than dizygotic twins OR dizygotic twins have fewer alleles in common ALLOW monozygotic twins are genetically identical	**(4)**

Question Number	Answer	Additional guidance	Mark
6(d)	An explanation that makes reference to the following: • histone modification / DNA methylation (1) • {affects activation of / activates / deactivates} genes (1) • affecting { enzyme production / metabolism } (1)	ALLOW acetylation of histones ALLOW genes being switched on or off	**(3)**

Question Number	Answer	Mark
7(a)	The only correct answer is – **D** 86% **A** is incorrect because the value calculated is for unsuccessful reintroduction **B** is incorrect because the value calculated is for unsuccessful reintroduction **C** is incorrect because the value is rounded incorrectly	**(1)**

Question Number	Answer	Additional guidance	Mark
7(b)	An explanation that makes reference to the following: • to allow the antelopes time to reproduce (1) • therefore providing a sustainable food source for the lions (1)	ALLOW reference to increase in population size ALLOW reference to antelope populations being able to survive predation	**(2)**

Question Number	Answer	Additional guidance	Mark
7(c)	An explanation that makes reference to two of the following: • increases chances of mating of unrelated lions (1) • lions will be from different gene pools (1) • maintain {heterozygosity / range of alleles} in offspring (1)	ALLOW lions will be genetically different	**(2)**

Question Number	Answer	Additional guidance	Mark
7(d)(i)	• number of hectares in Kwandwe divided by number of lions (1) • number of hectares in Kariega divided by number of lions (1) • value for Kariega subtracted from value for Kwandwe (1)	Example of calculation: 19978 ÷ 10 = 1997.8 50000 ÷ 8 = 6250 6250 – 1997.8 = 4252.2 ALLOW 4252 Correct answer with no working gains full marks	**(3)**

Question Number	Answer	Additional guidance	Mark
7(d)(ii)	An answer that makes reference to the following: • { more variety / higher number of species } (of carnivores) in Pumba (1) • Pumba has no wild dog population (1) • Schotia has a higher number of carnivores per hectare (1) • only shows data for carnivores (1)	ALLOW cheetah only found in Pumba ALLOW greater species richness in Pumba	**(4)**

Question Number	Answer	Additional guidance	Mark
8(a)	A description that makes reference to two of the following: • magnesium is essential to produce chlorophyll • chlorophyll is necessary to produce glucose during photosynthesis • glucose needed to produce cellulose for the cell walls		**(2)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	• calculation indicates correct percentage of mean tensile strength (1) • correct value for standard deviation provided (1)	Example of calculation 308.9 × 58.5% / 308.9 x 0.585 = 180.7 Correct answer without working gains full marks	**(2)**

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	An answer that makes reference to two of the following: • standard deviation gives an indication of the spread of the data (1) • standard deviation indicates validity of mean (1) • overlapping standard deviation values would indicate no difference between the means (1)	ALLOW can be used to show that there is a significant difference	**(2)**

Question Number	Answer	Additional guidance	Mark
8(c)(i)	An answer that makes reference to the following: • monomers are connected by 1-4 glycosidic links (1) • alternate monomers are inverted (1)	ALLOW answers in the form of a diagram	**(2)**

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	An answer that makes reference to six of the following: • extraction of individual fibres from seed pod/isolation of single fibre (1) • diameter of fibre measured { using callipers / microscopy } (1) • control of relevant named variable (1) • clamping fibres and hanging masses from the fibre (1) • adding increased mass at regular intervals until fibre breaks (1) • repeat to find a mean at each diameter (1) • divide the force by the cross-sectional area (to find	E.g. fibre length, humidity, temperature ALLOW determine mass required to break the fibre	**(6)**

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