PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



MARK SCHEME

SECTION 5: USE OF BIOLOGICAL RESOURCES (PACK 3)

SCORE	PERCENTAGE
/166	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Mark
(a)(i)	Circle around dendrites/cell body and dendrites	1

Question number	Answer	Additional guidance	Mark
(a)(ii)	Multiplication • 1.20 × 102 = 120 (1) Multiplication • 1.3 ÷ 120 = 0.0108/1.08 × 10^{-2} (1)	award full marks for correct numerical answer without working	2

Question number	Answer	Mark
(a)(iii)	Mitochondria	1

Question number	Answer	Additional guidance	Mark
(b)(i)	An answer that makes reference to the following points: • chromosome (1) • plasmid (1)	allow nucleoid	2

Question number	Answer	Mark
(b)(ii)	Stage Q	1

Question number	Answer	Mark
(b)(iii)	Stage R	1

(Total for question = 8 marks)

Q2.

Question Number	Answer	Mark
(a)	• hyphae (1) • chitin (1) • enzymes(1) • saprotrophic / saprophytic (1)	**4**

Question Number	Answer	Mark
(b)(i)	• carbon dioxide / CO_2 (1)	**1**

Question Number	Answer	Mark
(b)(ii)	An explanation that makes reference to the following: • increasing (kinetic) energy / molecules move more (1) • more collisions/ more enzyme substate complexes formed / eq (1) • above 37 / 40^{0}C /optimum / eventually / at higher temperature <u>enzyme</u> denatures / change in active site / substrate and enzyme can no longer bind /fit /eq (1)	**3**

Question Number	Answer	additional guidance	Mark
(b)(iii)	A description that makes reference to two of the following	no credit for counting bubbles or time for limewater as stem states in this experiment.	**2**
	• use (collect gas in) measuring cylinder / (gas) syringe / eq (1)	allow ref to capillary tube and scale ignore gas cylinder	
	• measure <u>volume / cm^3</u> in <u>time</u> / or <u>time</u> to produce <u>volume</u> /eq (1)	must refer to volume **and** time for mp 2	

Q3.

Question Number	Answer	Mark
(a)	the only correct answer is A anther B is not correct as ovary does not contain pollen grains C is not correct as petal does not contain pollen grains D is not correct as sepal does not contain pollen grains	**1**

Question Number	Answer	Mark
(b)(i)	An answer that makes reference to two of the following points: • supplies glucose / sucrose / sugar / carbohydrate / nutrients (1) • respiration / energy / ATP (1) • supplies amino acids (1) • make protein (1) • supplies water (1) • cell elongation / eq (1)	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	• 120 – 60 = 60 minutes • 4.7 – 1.4 = 3.3 in one hour • 3.3 ÷ 60 = 0.055 (3)	Award full marks for correct numerical answer without working Award 1 mark for 1.4 and 4.7 or 3.3 Award one mark for ÷ 60	**3**

Question Number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following points: C plus and minus pesticide / range of concentrations of pesticides (1) O same / variety / age / mass / size, of apple tree type (1) R use many trees / orchard / repeats / eq (1) M1 number of apples / mass of apples (1) M2 same time / stated period of time (1) S1 same soil / fertiliser / compost / water / eq (1) S2 light/ temp/ CO_2/ bees / eq (1)	 Allow same species Ignore yield	**6**
			Total 12 marks

Q4.

Question Number	Answer	Additional guidance	Mark
(a) (i)	• (substance that) speeds up (chemical) reactions (1)	**Allow** correct reference to activation energy **Ignore** catalyses	**1**

Question Number	Answer	Mark
(a) (ii)	• (chemical) reactions / processes in cells / cytoplasm / body /organisms (1)	**1**

Question Number	Answer	additional guidance	Mark
(b) (i)	An answer that includes: • scale linear and half of grid (1) • lines drawn neatly between points (1) • axis correct way around (1) • points correctly plotted (1) • axes labelled with (concentration in) **number of discs** (of potato) **and oxygen (production) in cm³ min $^{-1}$** or **cm³ per min** (1)	lose L if extrapolated bar charts lose L	**5**

Question Number	Answer	Additional guidance	Mark
(b) (ii)	An explanation that makes reference to the following points: • as enzyme concentration increases so does oxygen production / rate / it increases / eq (1) • up to 8 (discs) / 8.2 ($cm^3\ min^{-1}$) / levels off after / from 8 (discs) / 8.2 ($cm^3\ min^{-1}$) / eq (1) • more enzyme (molecules) available to react with / break down hydrogen peroxide / substrate / form enzyme substrate complexes / more collisions / eq (1) • until all substrate molecules / hydrogen peroxide are combined with enzyme molecules / substrate limiting (1)	must give value for discs or rate **Ignore** faster collisions	**3**

Question Number	Answer	Mark
(b) (iii)	• use (gas) syringe / (inverted) measuring cylinder / eq (1)	**1**

Question Number	Answer	additional guidance	Mark
(b) (iv)	An explanation that makes reference to the following points: • only one variable is changed / one independent variable / control variable / carry out valid experiment / produce accurate results / eq (1) • these (also) affect / change the rate (1)	**allow** make it a fair test **allow** so that they are controlled	**2**

Question Number	Answer	additional guidance	Mark
(b) (v)	• temperature / pH / type / eq of potato / eq (1)	**ignore** time	**1**

Q5.

Question Number	Answer	additional guidance	Mark
(a)	A description that makes reference to three of the following points • cross / breed / mate / allow to self- pollinate parent plant(s) with (grains) with highest mass / yield / desired characteristics / eq (1) • select offspring plants with (grains) with highest mass / yield / desired characteristics / eq(1) • repeat for more / many generations / eq (1)		**3**

Question Number	Answer	additional guidance	Mark
(b)(i)	• Scale half grid and linear (1) • Lines straight and through all points (1) • Axes correct way round (1) • Points correctly plotted within half a small square (1) • Units (yield in) tonnes per hectare (1)	allow y axis starting at 1 or 2 etc yield on y No P if extrapolate yield to 0 bar chart just loses L	**5**

Question Number	Answer	additional guidance	Mark
(b)(ii)	6.7-2.8= 3.9 3.9 ÷2.8 x 100 = 139.3 % in 60 years 139.3 ÷60 = 2.3% per year (3)	1 mark for 3.9 / 1.39 / 139/ 139.3/139.29/ etc 1 mark for ÷60 3 marks for correct answer no working allow 2.32 2.321 2.3214 2.32143 etc	**3**

Question Number	Answer	Mark
(b)(iii)	An explanation reference to three of the following points: • less energy used to grow tall /eq (1) • more energy available for grain/ eq (1) • higher yield / harvest / more grain(s) / grains heavier / eq (1) • less likely to fall over / less likely to be damaged by wind and rain / eq (1) • easier to harvest / eq (1)	**3**
		total 14 marks

Q6.

Question number	Answer	Mark
(a)(i)	A description that makes reference to three of the following points: • use information about milk yield of daughters/mothers (1) • to select bulls as male parents (1) • mate with cows with high milk yield (1) • repeat over generations (1)	3

Question number	Answer	Mark
(a)(ii)	An answer that makes reference to three of the following points: • cheaper/quicker to transport sperm than live bulls (1) • can use semen to mate with many cows (1) • can store semen after bull has died (1) • safer (for cows) (1)	3

Question number	Answer	Additional guidance	Mark
(b)	A description that makes reference to four of the following points: • control light intensity/use artificial lighting (1) • use heaters to increase temperature (1) • provide additional carbon dioxide (1) • provide additional minerals (1) • control water supply (1) • reduce damage by pests/use biological control (1)	ignore nutrients	4

(Total for question = 10 marks)

Q7.

Question Number	Answer	Mark
(a)(i)	A mitochondrion *B is incorrect because the nucleus does not carry out photosynthesis* *C is incorrect because ribosomes carry out protein synthesis* *D is incorrect because the vacuole sores sap*	**1**

Question Number	Answer	Mark
(a)(ii)	B chitin A is incorrect because fungal cell walls are not made of cellulose C is incorrect because fungal cell walls are not made of glycogen D is incorrect because fungal cell walls are not made of starch	**1**

Question Number	Answer	Mark
(a)(iii)	A cell membrane B is incorrect because prokaryotes do not contain mitochondria C is incorrect because prokaryotes do not contain nuclei D is incorrect because prokaryotes do not have vacuoles	**1**

Question Number	Answer	Additional guidance	Mark
(b)(i)	80 % (2)	one mark for 20 **Award full marks for correct answer**	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following: • (yeast) respires / fermentation / respiration (1) • producing / carbon dioxide (1) • (carbon dioxide) bubbles become trapped / stuck / inflate in dough (1)	**Reject** oxygen produced	**2**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that makes reference to two of the following: at 25 °C: • (kinetic) energy lower / molecules move slower / eq (1) • fewer collisions / fewer enzyme substrate complexes / further away from **enzyme** optimum / eq (1) • less carbon dioxide / gas released / eq (1)	**Accept** converse for 35 °C for all MPs	**2**

Question Number	Answer	Additional guidance	Mark
(b)(iv)	An explanation that makes reference to two of the following: at 35 °C • <u>enzymes</u> not denatured (1) • substrate fits into active site / active site shape not changed / eq (1) • so respiration continues / more carbon dioxide produced / yeast cells are alive / eq (1)	**Accept** converse for 65 °C for all MPs	**2**

Q8.

Question Number	Answer	Mark
(a)	<table><tr><th>Enzyme</th><th>Function</th><th>Name of process</th></tr><tr><td>**protease** / **pepsin** /eq (1)</td><td>breaks down protein into amino acids</td><td>**digestion** (1)</td></tr><tr><td>maltase</td><td>**maltose to glucose** (1)</td><td>digestion</td></tr><tr><td>**restriction /endonuclease** (1) Ignore helicase</td><td>cut DNA</td><td>genetic modification</td></tr></table>	**4**

Question Number	Answer	Mark
(b)(i)	The only correct answer is C 6.2 A is not correct as it is not 1.0 B is not correct as it is not 2.5 D is not correct as it is not 10.0	**1**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following points: • lower / slower at pH 1.0 / lower pH (1) • enzyme is denatured / active site is altered / change in shape of active site (1) • substrate no longer fits / binds / forms enzyme - substrate complexes /eq(1)	allow pH 2.5 is optimum allow converse for 2.5	**2**
			Total 7

Q9.

Question Number	Answer	Additional guidance	Mark
(a)	An answer that makes reference to the following points: • no chloroplast / no chlorophyll (1) • wall made of chitin (1)	allow plant cell has chlorophyll/ chloroplast cellulose cell wall ignore references to shape	**2 grad**

Question Number	Answer	Mark
(b)(i)	An explanation that makes reference to two of the following points: • aerobic respiration (1) • more energy / ATP (1) • anaerobic respiration produces alcohol (1) • kills yeast cells / eq (1)	**2 exp**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to two of the following points: • affects growth / kills yeast cells (1) • compete for / use up glucose (1) • remove pathogens (1)	Ignore 'competition' unqualified	**2 grad**

Question Number	Answer	Additional guidance	Mark
(b)(iii)	An answer that makes reference to three of the following points: • species of yeast / type of yeast / yeast from same batch (1) • temperature (1) • pH (of solution) (1) • concentration of glucose (1) • depth of sample (1) • view at same magnification / same area of field of view (1)	Allow same source of yeast Ignore light intensity Ignore volume of sample Ignore volumes of gases/named gases	**3 exp**

Question Number	Answer		Mark
(b)(iv)	An answer that makes reference to the following point: • reliable because results are similar / concordant / eq OR • not reliable because insufficient repeats / only three repeats done / eq		**1 grad**
		Total 10 marks	

Q10.

Question Number	Answer	Additional guidance	Mark
(a)(i)	An answer that makes reference to one of the following points: • cellulose (1) • glucose (1) • starch (1)	Allow named carbohydrate	**1 grad**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An answer that makes reference to two of the following points: • add ethanol (1) • add to water and look for white emulsion (1)	Allow Sudan III (1) turns red (1)	**2 grad**

Question Number	Answer	Mark
(a)(iii)	**all of** C H O N S **and no others** or **all of** carbon hydrogen oxygen nitrogen sulfur /sulphur **and no others**	**1 grad**

Question Number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to three of the following: • cell wall not broken down / cell wall not digested / cell wall still there (1) • (cell wall made of) cellulose / requires cellulase (1) • (cell) contents / organelles / named organelle(s) digested / broken down (1) • by enzymes (1)	Ignore cell membrane in mp1 Mp3 naming organelles alone is insufficient Mp4 refers to enzyme action on cell contents / organelles	**3 exp**

Question Number	Answer		Mark
(c)	An explanation that makes reference to six of the following points: <u>In support</u>: 1. can control growth rate (of grass) / give optimum conditions / controlled conditions / eq (1) 2. less chance of grass being eaten by insects / pests (1) 3. less wastage of minerals / reference to draining back minerals (1) 4. uses less land / space (than equivalent number of fields) (1) 5. fields can be used to grow other crops (1) 6. grass available in dry or cold part of the world / grass (harvest/growth) less weather dependent (1) 7. (fresh) grass available all year / continuous supply of (fresh) grass / higher yield (1) 8. animals move less / less (animal) heat loss, so more energy for (animal) growth (1)	Mp7 Ignore 'enough grass' 'lots of grass' unqualified	**6 exp**
	<u>Not in support</u>: 9. lighting / heating / electricity costs money (1) 10. expensive to build / high initial cost for building/machinery (1) 11. needs labour to fill trays / fill building (1) 12. lacks aesthetic appeal / eq (1) 13. manure not spread on fields (1) 14. animals are not able to graze at will / not free range (1)	Economic arguments in mp9, mp10, mp11 must be qualified - 'needs a lot of money'/eq alone is insufficient	
			Total 13 marks

Q11.

Question Number	Answer	Additional guidance	Mark
(a)	<table><tr><th>Function of vitamin</th><th>Vitamin</th></tr><tr><td>prevent scurvy</td><td>**C**</td></tr><tr><td>improve vision</td><td>(vitamin) A (1)</td></tr><tr><td>help bone growth</td><td>(vitamin) D (1)</td></tr></table>	allow retinoid / carotene allow calciferol	**2**

Question Number	Answer	Additional guidance	Mark
(b)(i)	rate without vitamin C: 6.5 – 0.5 = 6.0 ÷ 30 = 0.20 (2)	award full marks for correct numerical answer without working allow 1 mark for 6.0 or ÷ 30	**2**

Question Number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to two of the following points: • pour contents onto filter paper (in funnel) (1) • heat / warm in oven (1) • weigh the residue /eq (using balance) (1)	 allow filter ignore sieve allow to dry/ evaporate	**2**

Question Number	Answer	Mark
(b)(iii)	(dry) mass of yeast	**1**

Question Number	Answer	Additional guidance	Mark
(b)(iv)	An explanation that makes reference to four of the following points: • temperature (1) • because it affects enzymes / enzymes have optimum temperature / rate of reaction / kinetic energy of molecules /eq (1) Or • pH (1) • because it affects / denatures enzymes /eq (1) Or • oxygen / aerobic /anaerobic conditions /eq(1) • because it affects respiration (1) Or • species / strain / type of yeast (1) • because they may grow at different rates / eq (1) Or • <u>concentration</u> of glucose solution (1) • used in respiration by yeast (1)	ignore volume of glucose ignore mass of yeast ignore time ignore mass / conc of Vitamin C	**4**
		Total 11 marks	

Q12.

Question Number	Answer	additional guidance	Mark
(a)	An answer that makes reference to three of the following points: • quadrat (1) • repeat (1) • random / using coordinates / eq (1) • count / how many / amount / number /eq (1) • divide total /eq (count) by (area / number of) quadrats /eq (1)	use quadrats scores mp1 and mp 2	**3**

Question Number	Answer	additional guidance	Mark
(b)	An answer that makes reference to five of the following points: • BC numbers decline slower / CC numbers lower at start / February / eq (1) • CC numbers lower in some / April/ June / August / stated months /eq (1) • BC numbers are (overall) lower / eq (1) • BC stays low / less variable / CC go up and down / eq (1) • BC no need to reapply / insects reproduce / eq (1) • BC less risk of pollution / eq (1) • BC less risk of resistance /eq (1) • BC is specific / not affect (other) food chains /eq (1) • BC no bioaccumulation / eq (1) • BC could become pest /eq(1)	allow converse allow biomagnification	**5**
			Total = 8 marks

Q13.

Question Number	Answer	Mark
(a)(i)	**The only correct answer is C chitin glycogen** A is not correct as it is not cellulose and glycogen B is not correct as it is not cellulose and starch D is not correct as it is not chitin and starch	**1**

Question Number	Answer	Mark
(a)(ii)	**The only correct answer is B fungus** A is not correct as it is not a bacterium C is not correct as it is not a plant D is not correct as it is not a protoctist	**1**

Question Number	Answer	Mark
(b)(i)	**Only correct answer is B** **glucose → ethanol + carbon dioxide** A is not correct as it is not the correct equation C is not correct as it is not the correct equation D is not correct as it is not the correct equation	**1**

Question Number	Answer	additional guidance	Mark
(b)(ii)	• restriction / endonuclease / ligase (1)	allow correctly named endonuclease	**1**

Question Number	Answer		Mark
(b)(iii)	• contains new DNA / new gene / foreign DNA / foreign gene / altered genes / DNA from other organism/ DNA from other species / gene from other organism / gene form other species / contains gene for digesting cell walls / contains gene for digesting cellulose / gene for cellulase / eq /		**1**

Question Number	Answer		Mark
(b)(iv)	An answer that makes reference to two of the following points: • less burning of fossil fuels / eq (1) • less carbon dioxide in air / carbon neutral / plants use CO_2 (in photosynthesis) / eq (1) • less trapping of heat / less greenhouse effect / eq (1) • uses renewable resource (1)	allow named fossil fuel	**2**

Question Number	Answer	Additional guidance	Mark
(c)(i)	• 2.2 – 1.25 = • 0.95 ÷ 1.25 = 0.76 • × 100 = 76% (2)	award full marks for correct numerical answer without working allow 2.2 -1.3 =0.9 0.9÷1.3 = 0.69 ×100 = 69% allow 2.2 – 1.2 =1 1÷ 1.2= 0.8 0.8×100 = 80% allow 1 mark for dividing by mass of normal yeast / 1.2 to 1.3 percentage between 69 and 80 (2)	**2**

Question Number	Answer	additional guidance	Mark
(c)(ii)	An answer that makes reference to two of the following points: • running out of glucose / food / eq (1) • (build-up of) ethanol (1) • yeast cells die (1)	allow one mark for oxygen becomes available ethanol kills the yeast = mp2 and mp3	**2**
			Total 11 marks

Q14.

Question Number	Answer	Additional guidance	Mark
(a)(i)	B (fungi) is the only correct answer A is incorrect as animals are not single celled C is incorrect as plants do not have chitin or are single celled D is incorrect as protoctists do not have chitin		**1**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	An answer that makes reference to one of the following: • (viruses) do not grow (1) • (viruses) do not respire (1) • (viruses) are not sensitive / have internal control / eq (1) • (viruses) do not move (1) • (viruses) do not excrete (1) • (viruses) do not reproduce (independently) / need a host to reproduce / eq (1) • (viruses) do not feed / have a nutritional need / eq (1)	**Allow** do not carry out life processes / do not have all the characteristics of life /do not have MRSGREN(C) **Ignore** need another living organisms / host to live / survive **Ignore** need to live inside another cell	**1**

Question Number	Answer	Additional guidance	Mark
(b)	An answer that makes reference to the following: • restriction (enzymes) cut DNA /gene / plasmid / open plasmid / remove gene / eq (1) • ligase joins DNA to plasmid / joins DNA / joins sticky ends / inserts DNA / attaches DNA / eq (1)	**Allow** endonuclease **Reject** lipase	**2**

Question Number	Answer	Additional guidance	Mark
(c)(i)	An explanation that makes reference to three of the following: • respiration / fermentation / (chemical) reactions, releases heat (energy) (1) • checks / monitor, temperature **and** lets (cooling) water in / open valve / water is pumped around / eq (1) • lowers temperature / removes heat / prevents over heating / stops temperature getting too high (1) • maintain optimal temperature / optimum temperature (1) • stop enzymes denaturing / stops enzyme shape changing / eq (1)	**Ignore** cools it down alone	**3**

Question Number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that makes reference to two of the following: • (provides) oxygen (1) • for respiration / prevent anaerobic respiration (1)	**Reject** for anaerobic respiration	**2**

Question Number	Answer	Additional guidance	Mark
(c)(iii)	An explanation that makes reference to two of the following: • prevent other microbes / bacteria / fungi / pathogens / eq (1) • prevents contamination / contaminate (of product) / toxins (being released) / competition (for nutrients) / eq (1)	**Allow** remove bacteria / keep sterile **Ignore** germs / keep clean	**2**

Q15.

Question Number	Answer	additional guidance	Mark
	An answer that makes reference to six of the following points • C change carbon dioxide concentration / eq (1) • O use same plant species / same seeds / same variety /eq (1) • R repeat for each carbon dioxide concentration / eq (1) • M1 measure height / mass / yield of crop / number of fruit / eq (1) • M2 after stated time / same time (1) • S1 use same temperature / stated temperature / eq (1) • S2 water / minerals / nitrates / compost /soil / light intensity / period / eq (1)	ignore amount unqualified 4 weeks plus	**6**

Q16.

Question Number	Answer	Mark
(a)	An explanation that makes reference to two of the following: • anaerobic respiration (1) • (by) bacteria / named bacteria (1) • produces lactic acid / eq (1)	**2**

Question Number	Answer	Mark
(b)	• temperature / volume / mass of milk / lactose content of milk / type of milk / eq	**1**

Question Number	Answer	Additional guidance	Mark
(c)(i)	A graph that makes includes: • scales linear and at least half page and axes the correct way around time on x axis (1) • (time in) minutes **and** acidity %(1) • straight lines joining points (1) • points correctly plotted (1) • key to identify normal and low oxygen (1)	Allow truncated y axis if starts at 0.2 or 0 and // within a small square	**5**

Question Number	Answer	additional guidance	Mark
(c)(ii)	An explanation that makes reference to the following: • reduced oxygen (more) anaerobic respiration (of milk) / less <u>aerobic</u> respiration / eq (1) • acidity increases <u>faster</u> / sooner / more rapidly / eq (1)	allow converse for more oxygen	**2**