Mark Scheme (Results)

October 2025

Pearson Edexcel International Advanced Level in Biology
WBI14/01A

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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	Mark
1(a)	The only correct answer is **A** **B** *is incorrect because pathogens are any type of organism that can cause disease* ***C*** *is incorrect because pathogens are any type of organism that can cause disease and can be found in the cells and tissues as well as the blood* ***D*** *is incorrect because pathogens are any type of organism that can cause disease and can be found in the cells and tissues as well as the blood*	**(1)**

Question number	Answer	Additional guidance	Mark
1(b)(i)	An answer that includes two of the following points: **Any two from:** respiratory system / nose / mouth / airways / lungs / inhalation / breathing in urinogenital tract / reproductive system / genitals / sexual transmission damaged skin vector / injections / bites / transfusions (into blood) eyes ears (1)	**IGNORE** digestive system / names parts of digestive system e.g.anus **ACCEPT** descriptions e.g. open wound **IGNORE** direct contact unless qualified e.g. passing on athletes foot	**(1)**

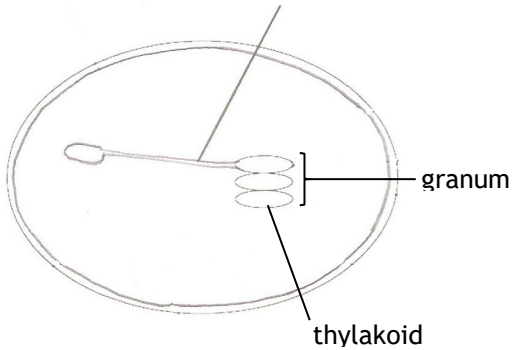
Question number	Answer	Additional guidance	Mark
1(b)(ii)	An answer that includes two of the following points: **Any two from:** skin / keratin / sebum / epithelial {tissue / cells} skin flora gut flora stomach acid / HCl / hydrochloric acid mucus / cilia blood clots ear wax {antimicrobials / enzymes / lysozyme} in {tears / saliva} eyebrows / eye lashes / nasal hair (1)	**IGNORE** immune system	**(1)**

Question number	Answer	Mark
1(b)(iii)	The only correct answer is **C** **A** *is incorrect because (104 ÷ 360) × 100 = 28.888888888888889 = 28.9* ***B*** *is incorrect because (104 ÷ 360) × 100 = 28.888888888888889 = 28.9* ***D*** *is incorrect because (104 ÷ 360) × 100 = 28.888888888888889 = 28.9*	**(1)**

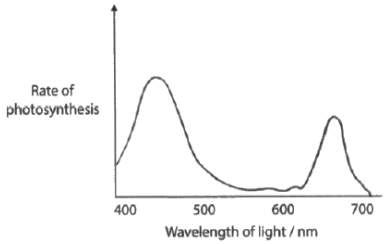
Question number	Answer	Additional guidance	Mark
1(b)(iv)	• 37.5 (%)	**ACCEPT** 38	**(1)**

Question number	Answer	Additional guidance	Mark
1(c)	A description that includes the following points: • phagocytosis of the bacteria (1) • (bacteria destroyed by) {lysosomal / digestive / hydrolytic} enzymes (1)	**ACCEPT** engulf description e.g. surrounded by pseudopodia and taken into the cell **IGNORE** envelop **ACCEPT** lysozyme enzymes released from lysosomes digested by enzymes **DO NOT ACCEPT** lysosome / lysozome	**(2)**

Question number	Answer	Mark
2(a)	The only correct answer is **C** **A** *is incorrect because not all cells contain chloroplasts e.g. phloem cells* ***B*** *is incorrect because not all cells contain chloroplasts e.g. phloem cells* ***D*** *is incorrect because not all cells contain chloroplasts e.g. phloem cells*	**(1)**

Question number	Answer	Additional guidance	Mark
2(b)(i)	An answer that includes the following points: • drawings : granum / grana / thylakoid **AND** lamellae (1) **IGNORE** other chloroplast structures drawn **DO NOT ACCEPT** non-chloroplast structures e.g. mitochondria, ER • one labelled membrane (1) • second labelled membrane (1) Correct labels: granum / grana (membrane) thylakoid (membrane) (stromal) lamellae / intergranal membrane / intergranal thylakoid	 **IGNORE** inner and outer membranes / envelope labelled lamellae	**(3)**

Question number	Answer	Mark
2(b)(ii)	The only correct answer is **A** **B** *is incorrect because RUBISCO is found in the stroma* ***C*** *is incorrect because RUBISCO is found in the stroma* ***D*** *is incorrect because RUBISCO is found in the stroma*	**(1)**

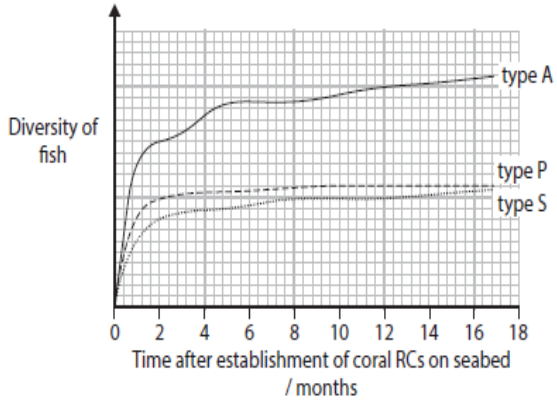
Question number	Answer	Additional guidance	Mark
2(c)	An answer that includes the following points: • a single line that rises and falls at the correct wavelengths (at least one peak all drawn between 400 and 500, 600 and 700) (1) **DO NOT ACCEPT** peaks outside these values, except a small peak just to the left of 600 • a line that does not touch the x axis, except at 700 (1)		**(2)**

Question number	Answer	Additional guidance	Mark
3(a)	• 3.48×10^4 / $3.48 \cdot 10^4$ / 3.5×10^4 / $3.5 \cdot 10^4$ (1)		**(1)**

Question number	Answer	Additional guidance	Mark
3(b)	An explanation that includes the following points: • description of anthropogenic activity (1) • explanation of how it affects coral reef (1)		**(2)**

Question number	Answer	Additional guidance	Mark
3(c)(i)	An explanation that includes the following points: • sexual reproduction increases the genetic {variation / diversity} so that {some coral / more coral} is likely to {survive / adapt} (1) • asexual reproduction {retains alleles that are suitable for survival / is faster / only requires one individual coral / produces large numbers of coral} (1)	**ACCEPT** the idea that environmental change, e.g. disease, will not wipe out lots of coral **IGNORE** easier descriptions of how they reproduce	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)(ii)	An answer that includes the following points: • description of difficulty (1) • explanation (1)		**(2)**

Question number	Answer	Additional guidance	Mark
		The graph shows the diversity of fish present with these types of coral RCs.  State **two** conclusions that can be made about the diversity of fish on these three types of coral.	
3(d)	An answer that includes the following points: • (overall) diversity increases in all three types of coral **OR** the diversity increases (in the first couple of months) and then levels off (in all types / in types P and S) (1) • type A coral supports the highest diversity (1)	**ACCEPT** type S (and P) supports the lowest diversity	**(2)**

Question number	Answer	Additional guidance	Mark
3(e)	A description that includes two of the following points: • {(counting) the number of / count the} (different) species (algae and animals) (1) • {(counting) the number / determining the abundance / determining the population of} each species (1) • {calculate / find / use} the (bio)diversity index / use the formula $\frac{N(N-1)}{\Sigma n(n-1)}$(1)	**ACCEPT** determine species richness **ACCEPT** determine the heterozygosity index **NB** if mp 1 not awarded for counting only coral or fish /animal species, penalise once **ACCEPT** named index e.g. Shannon, Simpson **DO NOT ACCEPT** Hardy-Weinberg, other wrongly named tests, wrong formula	**(2)**

Question number	Answer	Mark
4(a)(i)	The only correct answer is **C** **A** *is incorrect because it should be per square metre not per metre* ***B*** *is incorrect because it should be per square metre not per metre and per year* ***D*** *is incorrect because it should be per year*	**(1)**

Question number	Answer	Mark
4(a)(ii)	The only correct answer is **A** **B** *is incorrect because GPP is equal to the sum of NPP and R* ***C*** *is incorrect because GPP is equal to the sum of NPP and R* ***D*** *is incorrect because GPP is equal to the sum of NPP and R*	**(1)**

Question number	Answer	Mark
4(a)(iii)	The only correct answer is **C** **A** *is incorrect because (69 565 – 6 590) ÷ 69 565 = 0.905268 × 100 = 90.5* ***B*** *is incorrect because (69 565 – 6 590) ÷ 69 565 = 0.905268 × 100 = 90.5* ***D*** *is incorrect because (69 565 – 6 590) ÷ 69 565 = 0.905268 × 100 = 90.5*	**(1)**

Question number	Answer	Mark
***4(b)**	**Descriptions:** e.gs. Graph 1 : over the years / between 1990 and 2018 the number of otters increased Graph 2 : over the years erosion increased and decreased Graph 3 : as the number of otters increased, the predicted rate of erosion decreased Table : presence of otters {stopped the increase in the number of burrows/ increased the mass of roots} **Links between data supporting success:** • decrease in number of burrows as there are fewer crabs as the otters are feeding on them • fewer burrows so the soil is more stable decreasing erosion • more roots to stabilize the soil so less erosion • mass of pickleweed is increasing because there are fewer crabs, so their burrows are not damaging the roots • mass of pickleweed is increasing as there are fewer crabs eating them as the otters are feeding on the crabs • mass of pickleweed is increasing as there is more nitrogen available so could lower nitrogen (in water) levels • fewer crabs so less to decompose so less nitrogen released • the extent of erosion appears to be increasing despite the increase in the number of otters because it takes time for the otters to take effect **Contraindications that top-predator recovery could protect:** • limited data because only one {site / country} used • no error bars (clearly linked to table) so no indication if difference between otters present or absent is significant • all evidence is based on correlation therefore no evidence of causation • no evidence of causation • could the number of otters affect the {levels of nitrogen / sea levels} • more otters would lead to more decomposition which would increase nitrogen levels • would positive effect of otters out-weigh the negative effects of {rising sea levels / high nitrogen levels}?	**6**

			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	An answer may be attempted but with limited interpretation or analysis of the scientific information and 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.	Simple description 1 mark = one description of a visual 2 marks = three descriptions of visuals
Level 2	3-4	An answer 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.	Some implications discussed 3 marks = one link made between data 4 marks = two links made between data
Level 3	5-6	An answer is made that 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.	Detailed discussion 5 marks = three links made between data 6 marks = four links made with at least one link supporting its success and one contraindication

Question number	Answer	Mark
5(a)	The only correct answer is **A** **B** *is incorrect because sucrose is made from glucose and fructose* ***C*** *is incorrect because monosaccharides are joined by condensation reactions* ***D*** *is incorrect because sucrose is made from glucose and fructose which are joined by condensation reactions*	**(1)**

Question number	Answer	Additional guidance	Mark
5(b)	An answer that includes two of the following points: • (sucrose) lowers the water potential of their (cytoplasm / cell) / makes the (cytoplasm / cell) the same water potential as the water (1) • so that water does not move out (of the cytoplasm) by osmosis (1) • so the cytoplasm will not {shrink / decrease in volume} (1)	**ACCEPT** {increases solute concentration of / decreases solute potential of / more hypertonic / makes isotonic} cytoplasm **ACCEPT** prevents plasmolysis	**(2)**

Question number	Answer	Additional guidance	Mark
5(c)	An explanation that includes two of the following points: • less {carbon dioxide / methane / oxides of nitrogen} (produced / released / in the atmosphere) (1) • to reduce {climate change / global warming} (1) • explanation of an effect this would have (1)	**ACCEPT** greenhouse gases less depletion of non-renewable resources **IGNORE** less carbon **IGNORE** reduces greenhouse effect reduces the effect of {global warming / climate change} e.g. reduce the ice melting prevent wildlife being destroyed	**(2)**

Question number	Answer	Additional guidance	Mark
5(d)(i)	An answer that includes three of the following points: • sucrose (concentration) increases with (all) salt concentrations (1) • but no data on how much sucrose is released {without salt / with a control (1) • there is {not a positive correlation / no pattern / a non-linear relationship} between the (concentration of) sucrose and the concentration of salt (1) • no error bars so no indication of significance of differences (between salt concentrations) (1)	**DO NOT ACCEPT** there is a positive correlation between increase in sucrose and increase in salt concentration **IGNORE** positive correlation between sucrose and time **NB** must be in the context of salt concentration	**(3)**

Question number	Answer	Additional guidance	Mark
5(d)(ii)	A description that includes the following points: • sucrose (production) increases and then decreases (1) • cell biomass excluding sucrose (production) decreases (1) • sucrose and cell biomass excluding sucrose (produced) on all days except day {4 to 5 / 5} (1) • (overall) {proportion / percentage} of sucrose increases with time (1) • proportion of sucrose is (only) smaller than tota excluding sucrose on day 0 to 1 (1) • no error bars so cannot tell if differences are significant (1)	**IGNORE** explanations throughout **ACCEPT** increases (slightly) and then decreases **ACCEPT** {only sucrose / no cell biomass excluding sucrose} (produced) on day {4 to 5 / 5} **ACCEPT** converse for cell biomass **NB** linked to mp 1, 2, 4, 5	**(4)**

Describe the conclusions that can be made about the changes in the proportion of sucrose and cell biomass excluding sucrose produced during this time period.

Use the data in the graph to support your answer.

Question number	Answer	Additional guidance	Mark
6(a)	• {chemical / substance / drug / medicine} that (directly) {kills / destroys / inhibits the growth of} {bacteria / microorganisms / pathogens} (1)	**ACCEPT** a chemical that is {bacteriostatic / bactericidal} a chemical that inhibits reproduction of bacteria **IGNORE** harms / attacks / targeted / treatment / damages / antibacterial properties **DO NOT ACCEPT** viruses / antibodies	**(1)**

Question number	Answer	Additional guidance	Mark
6(b)(i)	• 10 % / 9.5 % / 9.53 % / 0.095 / 0.0953 / 0.1 / $^{1}/_{10}$ / 1 in 10 / $^{121}/_{1270}$	**ACCEPT** 0.10	**(1)**

Question number	Answer	Additional guidance	Mark
6(b)(ii)	• 700 (%) / 690 (%) / 687 (%)		**(1)**

Question number		Additional guidance	Mark
6(b)(iii)	An explanation that includes the following points: • description of a code of practice (1) • explanation of how it could reduce the increase in antibiotic-resistant bacteria (1)		**(2)**

Question number	Answer	Mark
***6(c)(i)**	Culturing method • culture MRSA with and without the compounds (D) • so that the effect of the compounds can be measured (E) • bacteria grown on agar / liquid broth (D) • to provide bacteria with nutrients for growth (E) • at temperature around 37°C / pH (D) • so that the bacterial enzymes function / so that the bacteria will grow / temperature that human pathogens grow (E) • tape lid of petri dish on loosely / to ensure aerobic conditions (D) • to prevent the growth of anaerobic pathogens (E) Aseptic technique (max 2) • use aseptic technique / method described (D) • prevent infection with MRSA (E) • reason why we need to prevent contamination of culture (E) • reason why the method works (E) (max 1) e.g. work by bunsen (to create updraft) to move bacteria away (from culture) Data collection (must match method) • measure size of zone of inhibition (D) • because the larger the zone the greater the effect of the compound (E) • measure the turbidity of the culture (D) • because the less turbid the more effective the compound (E) • use cell counts (D) • as these only count living bacteria (E) • use dilution counts (D) • so that the number of colonies can be counted (E) Assessing repeatability / significance • control named variable (D) so that the {method / data} is valid (E) • set up multiple cultures (D) for repeatability (E) • take several measurements of zone of inhibition (D) for accuracy (E) • carry out a statistics test (D) to determine the significance of any differences in turbidity / zone of inhibition (E)	**6**

			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	An answer may be attempted but with limited interpretation or analysis of the scientific information and 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.	Simple description 1 mark = one description 2 marks = three descriptions
Level 2	3-4	An answer 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.	Some reasons given 3 marks = one reason given 4 marks = two reasons given
Level 3	5-6	An answer is made that 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.	Detailed explanation 5 marks = three reasons given 6 marks = four reasons given

Question number	Answer	Additional guidance	Mark
6(c)(ii)	An explanation that includes the following points: • {bacteria / MRSA} {are / are becoming} resistant to (available) antibiotics (1) • because of this resistance new antibiotics need to be {discovered / developed / made} (1) • AI is fast(er) (than current development methods) (1) • AI would be cheaper (than current development methods) (1) • AI could identify {bacterial targets / antibiotics with no side effects / dosage} (1)	**ACCEPT** current methods take a long time	**(3)**

Question number	Answer	Additional guidance	Mark
7(a)	• {29.76 / 29.8} (km) / area calculated in miles^2 (1) • 2657 / 2746 / 2781 / 2782 / 2783 (km^2) (1)	**ACCEPT** 2745.5 / 2782.4 / 2782.7 Bald answer of: 2657 / 2746 / 2781 / 2782 / 2783 or to 1 dp = 2 marks 2656.9728 / 2745.5385 / 2780.9648 / 2782.3754 / 2782.73618 correctly rounded up to value with more than 1 decimal place = 1 mark 29.76 / 29.8 = 1 mark Area in miles to 1 dp max = 1 mark	**(2)**

Question number	Answer	Additional guidance	Mark
7(b)(i)	An explanation that includes the following points: • increase in temperature increases the kinetic energy (of enzymes / substrates) (1) • resulting in more collisions between enzymes and substrates (1) • example of type of {enzyme / process} (that could decrease life cycle time) (1)	**ACCEPT** converse for decrease change in shape of active site at high temperatures **ACCEPT** more ESCs converse for decrease / above optimum e.g. faster {respiration / sperm swimming speed / mitosis / DNA polymerase activity / protein synthesis / metabolism / cell division} **ACCEPT** converse for increase life cycle time	**(3)**

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that includes three of the following points: • nematodes {are lower order organisms / have fewer ethical issues} (1) • there are nematodes that have survived radiation whereas other organisms may not (1) • the life cycle is fast so {increased chances of mutations occurring / more mutations present / several generations to study} (1) • large number of {eggs /nematodes} produced which {improves repeatability / which gives a large sample size} (1) • nematodes live in a range of environments so {there are control nematodes / comparisons can made} (1) • nematodes exposed to radiation a long time ago so {long-term effect can be studied / changes in allele frequency can be observed} (1)	**ACCEPT** simpler nervous system / brain may not feel pain not endangered **ACCEPT** which results in a genetically diverse population so more mutations (likely to have occurred)	**(3)**

Question number		Additional guidance	Mark
7(c)(i)	A description that includes four of the following points: • (collect) DNA from the cells of these nematodes (1) • and DNA from nematodes found in unaffected areas (1) • use PCR / amplify the DNA (1) • use (gel) electrophoresis (1) • to {compare / look for changes in} the {number / size / position / pattern} of <u>bands</u> (produced by gel electrophoresis (1)	**ACCEPT** named cell / faeces **ACCEPT** description DNA profiling / DNA sequencing / molecular phylogeny **ACCEPT** common base sequences / common DNA markers / common alleles / polymorphisms **NB** must be correct for the method if mp 4 awarded	**(4)**

Question number	Answer	Additional guidance	Mark
7(c)(ii)	An explanation that includes three of the following points: • nematodes affected by mutations {die / are infertile} (1) • nematodes are resistant to {mutations / (effects of) radiation / credit a possible way that this could happen (1) • nematodes were protected from radiation / credit a possible way that this could happen (1) • resistant nematodes (reproduce and) can pass the alleles for resistance on to offspring (1) • interbreeding with nematodes outside exclusion zone mixed the alleles (1)	e.g. DNA polymerase activity, DNA repaired, e.g. live underground, tough skin, levels of radiation not high enough to cause mutations	**(3)**

Question number	Answer	Mark
8(a)(i)	The only correct answer is **C** **A** *is incorrect because B cells do not have the CD4 receptor protein* ***B*** *is incorrect because macrophages do not have the CD4 receptor protein and HIV only gains entry by phagocytosis* ***D*** *is incorrect because T killer cells do not have the CD4 receptor protein*	**(1)**

Question number	Answer	Additional guidance	Mark
8(a)(ii)	An explanation that includes the following points: • because envelope is {a membrane / made of phospholipids} (1) • and phospholipids can move (within the two membranes) (1)	**ACCEPT** HIV (envelope) has a phospholipid bilayer **ACCEPT** because {(HIV) membrane / envelope} fluid because of the fluid (mosaic) model	**(2)**

Question number	Answer	Additional guidance	Mark
8(b)	An explanation that includes the following points: • introns (and some exons) have to be {removed / spliced} (1) • because they do not code for {amino acids / components} in the *env* protein (1)		**(2)**

Question number	Answer	Additional guidance	Mark
8c(i)	An explanation that includes three of the following points: • it will {not stimulate (primary) immune response / stimulate a weak (primary / HI / CMI) immune response} (1) • therefore {none / few / less} {B / T} cells {activated / stimulated} (1) • and therefore {no / few / less} memory cells produced (1) • therefore {no / slow} secondary immune response (if primary IR not initiated) (1)	**ACCEPT** cannot be presented by {APC / macrophages} not recognized as foreign clonal selection will not take place **ACCEPT** clonal expansion of {B / T} cells	**(3)**

Question number	Answer	Additional guidance	Mark
8(c)(ii)	An explanation that includes two of the following points: • (if the antibodies cannot bind strongly then) then {opsonization / agglutination} (of the HIV) will {not occur / be reduced} (1) • reducing phagocytosis (of HIV) / so fewer HIV will be destroyed (1)	**ACCEPT** macrophages will not be able to bind (to the antibody) to the {glycoprotein / HIV} the antibodies will not clump HIV together **DO NOT ACCEPT** antibodies cannot destroy virus / HIV **ACCEPT** phagocytosis will not be enhanced **DO NOT ACCEPT** in context of initiation of immune response	**(2)**

Question number	Answer	Additional guidance	Mark
8(c)(iii)	An explanation that includes the following points: • because mutation will change the amino acids (sequence) (1) • so that the (*env*) {protein / antigen} will be a different shape (1) • (secondary) immune system will not be initiated (1)	**ACCEPT** different {protein / antigen} produced **ACCEPT** {immune system / memory cells} will not {recognise / detect} these antigens there will not be antibodies for these (new) antigens another primary response needs to be initiated (remaining) antibodies will not be able to bind to these altered antigen	**(3)**

Question number	Answer	Additional guidance	Mark
8(c)(iv)	An answer that includes two of the following points: • more of the *env* protein will be exposed (1) • therefore there are more possible parts of the protein that might be antigenic (1) • therefore {more antibodies to bind to the protein / increasing opsonization / increasing agglutination} (1) • increasing {phagocytosis / destruction} by macrophages (1)	**ACCEPT** descriptions of agglutination **DO NOT ACCEPT** antibodies destroy HIV **DO NOT ACCEPT** in context of initiating primary immune response	**(2)**