



**GCE**

**Biology B**

**H022/02: Biology in depth**

AS Level

**Mark Scheme for June 2022**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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## MARKING INSTRUCTIONS

### PREPARATION FOR MARKING

#### RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

#### MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

## 5. Work crossed out:

Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

**Rubric Error Responses – Optional Questions**

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. (The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)

**Multiple Choice Question Responses**

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate). When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

**Contradictory Responses**

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

**Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)**

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. (The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)

**Short Answer Questions (requiring a more developed response, worth two or more marks)**

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

**Longer Answer Questions (requiring a developed response)**

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional

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judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
  - if there is nothing written at all in the answer space
  - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
  - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

**The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

**The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

**In summary:**

**The skills and science content determines the level.**

**The communication statement determines the mark within a level.**

Level of response questions on this paper are **2b** and **4d**.

















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## 11. Annotations available in RM Assessor

## Marking Annotations

Annotation	Use
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
	Benefit of the doubt not given
	Tick
	Omission Mark
	Blank Page
	Level 1 answer in Level of Response question
	Level 2 answer in Level of Response question
	Level 3 answer in Level of Response question

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12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	Or reverse argument



### 13. Subject-specific Marking Instructions

#### INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Mark	AO element	Guidance
1	(a)	(i)	cell A = Prophase ✓ cell B = Metaphase ✓	2	AO1.2	
1	(a)	(ii)	alter proportions / make cell wall thinner ✓ don't sketch / draw continuous lines / AW ✓	2	AO3.2	<b>IGNORE</b> comments about other organelles / more labels / annotation
1	(b)		<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 0.45 (%) award 2 marks</b>  6.5/1440 ✓ x100 ✓	2	AO2.8	<b>ALLOW</b> two marks for correct answer to any number of decimal places e.g. 0.45138889
1	(c)		<i>G1 checkpoint</i>  check for, cell size / sufficient nutrients / energy reserves (before allowing DNA replication) ✓  <i>G2 checkpoint</i>  check for, cell size / DNA damage / DNA replication ✓	2	AO1.2	<b>IGNORE</b> descriptions of G1 and G2  <b>ALLOW</b> enough proteins have been synthesised / organelles have been produced
1	(d)		cell shrinkage ✓  nuclear condensation / pyknosis ✓  blebs form ✓  nuclear fragmentation / karyorrhexis ✓  ref to the roles of phosphatidylserine / macrophages ✓	3 max	AO1.1	<b>ALLOW</b> phonetic spelling  <b>ALLOW</b> phonetic spelling
<b>TOTAL:</b>				<b>11</b>		

Question			Answer	Mark	AO element	Guidance
2	(a)	(i)	<p>as volume of water increases number of lenticels increase (and decreases) ✓</p> <p>below 700 cm<sup>3</sup> variety 2 has more lenticels / above 700 cm<sup>3</sup> variety 1 has more lenticels ✓</p> <p>use of comparative data , including units ✓</p>	2 max	AO3.1	ALLOW any value below 700 for variety 2 / above 700 for variety 1
2	(a)	(ii)	<p><i>Suitable method because</i></p> <p>it allows a quantitative comparison ✓</p> <p><i>Not a suitable method because</i></p> <p><b>Max 3</b></p> <p>(also affected by) soil moisture ✓</p> <p>(also affected by) rate of transpiration ✓</p> <p>not all of the water will be taken up by the trees ✓</p> <p>other variables / named variable not controlled ✓</p>	4 max	AO3.4	
2	(a)	(iii)	<p>no evidence of , replicates / means calculated ✓</p> <p>(so) no statistical test carried out ✓</p>	2	AO3.1	ALLOW no named statistical test
2	(a)	(iv)	<p>windspeed <b>and</b> use a fan at a constant speed ✓</p> <p>light intensity <b>and</b> use a lamp at a specific distance ✓</p>	2	AO3.4	<p>IGNORE ref to temperature</p> <p>ALLOW idea of same light source in laboratory</p>

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			humidity <b>and</b> use (de)humidifier (with humidistat) ✓ pH <b>and</b> use buffer (in water supply) ✓			
2	(a)	(v)	divide number of lenticels by total surface area (of apple) ✓  apples vary , in size / surface area ✓	2	AO3.3	

Question		Answer	Mark	AO element	Guidance
2	(b)*	<p><b>Summary of instructions to markers:</b>  <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)            Using a ‘best-fit’ approach based on the science content of the answer, first decide which of the level descriptors, <b>Level 1</b>, <b>Level 2</b> or <b>Level 3</b>, best describes the overall quality of the answer.            Then, award the higher or lower mark within the level, according to the <b>Communication Statement</b> (shown in italics):</i></p> <ul style="list-style-type: none"> <li>○ <i>award the higher mark where the Communication Statement has been met.</i></li> <li>○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i></li> </ul> <p>• <b>The science content determines the level.</b>            • <b>The Communication Statement determines the mark within a level.</b></p>			

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		<p><b>Level 3 (5–6 marks)</b> Provides detailed similarities <b>AND</b> differences in gas exchange between lenticels <b>AND</b> stomata.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> Provides a description of a difference <b>AND</b> a similarity between gas exchange in lenticels and stomata.</p> <p><b>OR</b></p> <p>Provide a description of differences <b>OR</b> similarities</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> Provides a description of a difference <b>OR</b> a similarity between gas exchange in lenticels <b>AND</b> stomata. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b> No response or no response worthy of credit</p>	<b>6</b>	<b>AO1.2</b>	<p><b>Indicative points include</b></p> <table border="1"> <thead> <tr> <th><u>Lenticels</u></th> <th><u>Stomata</u></th> </tr> </thead> <tbody> <tr> <td>Less gas exchange</td> <td>More gas exchange</td> </tr> <tr> <td>Occurs mainly on the bark</td> <td>Occurs mainly on leaves / lower epidermis</td> </tr> <tr> <td>Occurs all of the day – no opening/closing</td> <td>Only occurs some of the day/open in light and closed in dark</td> </tr> <tr> <td>Occurs without guard cells</td> <td>Occurs with guard cells</td> </tr> <tr> <td>Main function is for respiration (O<sub>2</sub> in/CO<sub>2</sub> out)</td> <td>Main function is for photosynthesis (CO<sub>2</sub> in during daylight)</td> </tr> <tr> <td>No use of ATP</td> <td>ATP used to increase rate (opening stomata)</td> </tr> <tr> <td>No changes in cell turgor pressure</td> <td>Changes in guard cell turgor pressure to change rate</td> </tr> <tr> <td>Raised</td> <td>Sunken</td> </tr> <tr> <td>Less numerous</td> <td>Greater number</td> </tr> <tr> <td>Less surface area</td> <td>More surface area</td> </tr> </tbody> </table> <p><i>In both</i></p> <ul style="list-style-type: none"> <li>• Gas exchange by diffusion</li> <li>• Between air spaces within plant and atmosphere</li> <li>• Both will result in some loss of water vapour (could also be a difference – more via stomata)</li> <li>• Rate of gas exchange affected by environmental conditions</li> <li>• Occur on surfaces Involved with movement of oxygen and carbon dioxide</li> </ul>	<u>Lenticels</u>	<u>Stomata</u>	Less gas exchange	More gas exchange	Occurs mainly on the bark	Occurs mainly on leaves / lower epidermis	Occurs all of the day – no opening/closing	Only occurs some of the day/open in light and closed in dark	Occurs without guard cells	Occurs with guard cells	Main function is for respiration (O <sub>2</sub> in/CO <sub>2</sub> out)	Main function is for photosynthesis (CO <sub>2</sub> in during daylight)	No use of ATP	ATP used to increase rate (opening stomata)	No changes in cell turgor pressure	Changes in guard cell turgor pressure to change rate	Raised	Sunken	Less numerous	Greater number	Less surface area	More surface area
<u>Lenticels</u>	<u>Stomata</u>																										
Less gas exchange	More gas exchange																										
Occurs mainly on the bark	Occurs mainly on leaves / lower epidermis																										
Occurs all of the day – no opening/closing	Only occurs some of the day/open in light and closed in dark																										
Occurs without guard cells	Occurs with guard cells																										
Main function is for respiration (O <sub>2</sub> in/CO <sub>2</sub> out)	Main function is for photosynthesis (CO <sub>2</sub> in during daylight)																										
No use of ATP	ATP used to increase rate (opening stomata)																										
No changes in cell turgor pressure	Changes in guard cell turgor pressure to change rate																										
Raised	Sunken																										
Less numerous	Greater number																										
Less surface area	More surface area																										
	<b>Total:</b>	<b>18</b>																									

Question			Answer	Mark	AO element	Guidance
3	(a)	(i)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer = 8 (per 100 000 people) award 2 marks</b></p> <p>(5300/66000000)✓            = 8 ✓</p>	2	AO2.4	ALLOW 1 mark for 7.958
3	(a)	(ii)	<p>yes, if the current trend continues ✓</p> <p><i>no</i>, because it looks like the trend,            is slowing down / might reach a plateau ✓</p> <p>data quote to illustrate change between two dates ✓</p>	2	AO3.1	
3	(b)		<p>education / advice, on how TB is transmitted ✓</p> <p>screening of population for TB ✓</p> <p>more / better , equipment / ventilators ✓</p> <p>(increase) research into antibiotics ✓</p> <p>(increase) vaccination programme ✓</p> <p>notify contacts ✓</p> <p>reduce overcrowding ✓</p> <p>isolation ✓</p>	3 max	AO2.1	

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<b>3</b>	<b>(c)</b>	<b>(i)</b>	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 14 award 2 marks</b>  (28+14) = 42 <b>AND</b> (1+2) = 3 ✓ 42 / 3 = 14 ✓	<b>2</b>	<b>AO2.4</b>	<b>ALLOW</b> 42/2 = 21 <b>AND</b> 3/2 =1.5 (if average percentages calculated)
<b>3</b>	<b>(c)</b>	<b>(ii)</b>	number of people in each age group could be different ✓  lifestyle differences ✓  compliance differences ✓	<b>2</b>	<b>AO3.2</b>	
			Total	<b>11</b>		

Question			Answer	Mark	AO element	Guidance
<b>4</b>	<b>(a)</b>	<b>(i)</b>	pathogen killed ✓  contains antigen ✓	<b>1 max</b>	<b>AO2.1</b>	

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4	(a)	(ii)	<p><i>Advantage</i></p> <p>more effective / longer lasting immunity ✓  <b>OR</b>  can replicate so more antigenic material formed ✓  <b>OR</b>  greater immune response / greater symptoms ✓</p> <p><i>Disadvantage</i></p> <p>greater side effects / possible infection ✓  <b>OR</b>  may be having chemotherapy / have HIV /  immunocompromised ✓</p>	2 max	AO1.1	<b>ALLOW</b> less need for boosters
4	(b)		<p><i>For</i></p> <p>they have a weak immune system /  haven't developed many immune cells / haven't  received antibodies from mother ✓</p> <p><i>Against</i></p> <p>causes pain / cannot give consent / AW ✓</p>	2	AO2.2	
4	(c)	(i)	<p><i>idea that</i> vaccinating the majority  reduces the chance of a disease spreading ✓</p>	1	AO2.1	<b>ALLOW</b> provides herd immunity
4	(c)	(ii)	<p>proteins are used to make antibodies /  less antibodies produced ✓</p> <p>proteins are used to make lymphocyte /  memory cells will not be produced ✓</p>	2 max	AO2.1	<b>ALLOW</b> named lymphocytes



Question	Answer	Mark	AO element	Guidance
4	(d)*			
	<p><b>Summary of instructions to markers:</b>  <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, <b>Level 1</b>, <b>Level 2</b> or <b>Level 3</b>, best describes the overall quality of the answer.</i>  <i>Then, award the higher or lower mark within the level, according to the <b>Communication Statement</b> (shown in italics):</i></p> <ul style="list-style-type: none"> <li>○ <i>award the higher mark where the Communication Statement has been met.</i></li> <li>○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i></li> </ul> <ul style="list-style-type: none"> <li>• <b>The science content determines the level.</b></li> <li>• <b>The Communication Statement determines the mark within a level.</b></li> </ul>	6	AO1.2 AO2.1	<p><b>Indicative scientific points may include</b></p> <p><b>Types of pathogenic material</b></p> <ul style="list-style-type: none"> <li>• whole organism needs to have similar antigens</li> <li>• live vaccines must be attenuated</li> <li>• potential risk of disease from attenuated vaccine</li> <li>• dead / antigen vaccine triggers less immunity</li> <li>• toxoid can only be used when a toxin is produced</li> </ul> <p><b>Problems with the pathogen</b></p> <ul style="list-style-type: none"> <li>• high mutation rates of pathogen</li> <li>• antigen variability</li> <li>• unknown mode of transmission</li> <li>• pathogen may not cause symptoms in everyone</li> <li>• cells may go through different stages</li> </ul> <p><b>Problems with making the vaccine</b></p>
	<p><b>Level 3 (5–6 marks)</b>  Provides a comprehensive explanation of the problems with different types of pathogenic material <b>AND</b> problems with the pathogen <b>AND</b> problems with making the vaccine.  <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b>  Provides a good explanation for the problems with different types of pathogenic material <b>AND</b> problems with the pathogen <b>OR</b> problems with making the vaccine.  <b>OR</b>  Provides a good explanation for the problems with different types of pathogenic material <b>OR</b> problems with the pathogen <b>AND</b> problems with making the vaccine.  <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b></p>			

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		<p>Provides some explanation for the problems with different types of pathogenic material <b>OR</b> with the pathogen <b>or</b> with making the vaccine.  <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b>          No response or no response worthy of credit</p>			<ul style="list-style-type: none"> <li>• time consuming</li> <li>• requires trials / volunteers</li> <li>• potential side effects of immune response</li> <li>• general health of the target group</li> <li>• scale of production</li> <li>• cost</li> <li>• ethics e.g. third world / animal testing</li> </ul>
			<b>Total:</b>	<b>14</b>	

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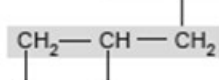
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Question		Answer	Mark	AO element	Guidance
5	(a)	Thr <b>AND</b> Pro <b>AND</b> Lys ✓	1	AO2.5	
5	(b)	(i) 4 bases ✓ 4 <sup>3</sup> / 4x4x4 ✓	2	AO2.7	<b>ALLOW</b> letters for bases
5	(b)	(ii) degenerate code ✓ more than one codon for the same amino acid ✓ (stop codons) stop the ribosome from translating ✓	2 max	AO2.5	
	(c)	different protein ✓ increased length ✓ changed tertiary structure ✓	2	AO2.5	
		<b>Total</b>	<b>7</b>		

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Question			Answer	Mark	AO element	Guidance
6	(a)	(i)	correctly drawn box ✓	1	AO1.1	
6	(a)	(ii)	makes it , unsaturated / have less hydrogen atoms / kink ✓	1	AO1.1	
6	(b)	(i)	<i>idea that</i> mitochondrial membrane is less, fluid / flexible , than a cell surface membrane ✓ cholesterol regulates the fluidity of the membrane ✓ cholesterol stabilises the membrane ✓ <i>idea that</i> mitochondria are organelles within the cell ✓	2	AO2.1	<b>ALLOW</b> cholesterol changes the way phospholipids to pack together
6	(b)	(ii)	<i>idea that</i> lipids can be different sizes / masses ✓	1	AO1.2	
6	(c)		<b>S1</b> Increased ATP production <b>E1</b> (active transport), requires ATP / energy ✓  <b>S2</b> increased temperature ✓ <b>E2</b> increases rate of enzyme activity in respiration ✓  <b>S3</b> increased oxygen availability ✓ <b>E3</b> increases rate of aerobic respiration ✓  <b>S4</b> increased glucose concentration ✓ <b>E4</b> increased substrate availability for respiration ✓  <b>S5</b> increased number of carrier proteins ✓ <b>E5</b> more molecules ca move (at the same time) ✓	4 max	AO2.5	<b>Mark in pairs</b>  <b>DO NOT ALLOW</b> 'production of energy'
<b>Total</b>				<b>9</b>		

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