



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**Leaving Certificate 2013**

**Marking Scheme**

**Biology**

**Higher Level**

## **Note to teachers and students on the use of published marking schemes**

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work. In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

### **Future Marking Schemes**

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year.

Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice

## Introduction

The marking scheme is a guide to awarding marks to candidates' answers. It is a concise and summarised guide and is constructed so as to minimise its word content.

Examiners must conform to this scheme and may not allow marks for answering outside this scheme.

The scheme contains key words, terms and phrases for which candidates may be awarded marks. This does not preclude synonyms or terms or phrases which convey the same meaning as the answer in the marking scheme.

Although synonyms are generally acceptable, there may be instances where the scheme demands an exact scientific term or unequivocal response and will not accept alternatives.

The descriptions, methods and definitions in the scheme are not exhaustive and alternative valid answers are acceptable. If it comes to the attention of an examiner that a candidate has presented a valid answer and there is no provision in the scheme for accepting this answer, then the examiner must first consult with his/ her advising examiner before awarding marks. As a general rule, if in doubt about any answer, examiners should consult their advising examiner before awarding marks.

Key words or terms or phrases may be awarded marks, only if presented in the correct context.

e.g.

Question: Outline how water from the soil reaches the leaf.

Marking scheme: Concentration gradient/ root hair/ osmosis/ cell to cell/ root pressure/ xylem/ cohesion (or explained)/ adhesion (or capillarity or explained)/ Dixon and Joly/ transpiration **or** evaporation/ tension any six **6(3)**

Answer: "Water is drawn up the xylem by osmosis" Although the candidate has presented two key terms (xylem, osmosis), the statement is incorrect and the candidate can only be awarded 3 marks for referring to the movement of water through the xylem.

## Cancelled Answers

The following is an extract from S.63 *Instructions to Examiners, 2013* (section 7.3, p.22)

"Where a candidate answers a question or part of a question once only and then cancels the answer, you should ignore the cancelling and treat the answer as if the candidate had not cancelled it."

e.g.

Question: What is pollination?

Marking scheme: Transfer of pollen/ from anther/ to stigma **3(3) marks**

Sample Answer: ~~transfer of pollen/ by insect/ to stigma~~

The candidate has cancelled the answer and has not made another attempt to answer the question and may be awarded 2(3) marks.

If an answer is cancelled and an alternative version given, the cancellation should be accepted and marks awarded, where merited, for the uncanceled version only.

If two (or more) uncanceled versions of an answer are given to the same question or part of a question, both (or all) should be marked and the answer accepted that yields the greater (greatest) number of marks. Points may not, however, be combined from multiple versions to arrive at a manufactured total.

## Surplus Answers

**In Section A, a surplus wrong answer cancels the marks awarded for a correct answer.**

e.g.

Question: The walls of xylem vessels are reinforced with .....

Marking Scheme: lignin **4 marks**

Sample answers:

- chitin, lignin – there is a surplus answer, which is incorrect, therefore the candidate scores 4 – 4 marks = 0.
- ~~lignin~~ – the answer, which is correct, has been cancelled, but there is no additional or surplus answer, therefore the candidate may be awarded 4 marks.
- lignin, ~~chitin~~ - there is a surplus answer, which is incorrect, but it has been cancelled and as the candidate has given more than one answer (i.e. the candidate is answering the question more than once only), the cancelling can be accepted and he/ she may be awarded 4 marks.

Question: Name the **four** elements that are always present in protein

Marking Scheme: Carbon/ hydrogen/ oxygen/ nitrogen **4(3)**

Sample answers:

- Carbon, hydrogen, oxygen, nitrogen, calcium – there is a surplus answer, which is incorrect, and which cancels one of the correct answers, therefore the candidate is awarded **3(3)** marks.
- Carbon, hydrogen, oxygen, calcium – there is no surplus answer, there are three correct answers, therefore the candidate is awarded **3(3)** marks.
- Carbon, hydrogen, oxygen, calcium, aluminium – there is a surplus answer, which is incorrect, and which cancels one of the three correct answers, therefore the candidate is awarded **2(3)** marks.
- Carbon, hydrogen, oxygen, calcium, ~~aluminium~~ – there is a surplus answer, which is incorrect, but it has been cancelled so the candidate may be awarded **3(3)** marks.

In the other sections of the paper, there may be instances where a correct answer is nullified by the addition of an incorrect answer. This happens when the only acceptable answer is a specific word or term. Each such instance is indicated in the scheme by an asterisk \*.

## Conventions

- Where only one answer is required, alternative answers are separated by ‘or’.
- Where multiple answers are required each word, term or phrase for which marks are allocated is separated by a solidus ( / ) from the next word, term or phrase.
- The mark awarded for an answer appears in bold next to the answer.
- Where there are several parts in the answer to a question, the mark awarded for each part appears in brackets e.g. **5(4)** means that there are five parts to the answer, each part allocated 4 marks.
- The answers to subsections of a question may not necessarily be allocated a specific mark; e.g. there may be six parts to a question – (a), (b), (c), (d), (e), (f) and a total of 20 marks allocated to the question. The marking scheme might be as follows: **2(4) + 4(3)**. This means that the first two correct answers encountered are awarded 4 marks each and each subsequent correct answer is awarded 3 marks.
- A word or term that appears in brackets is not a requirement of the answer, but is used to contextualise the answer or may be an alternative answer.

<b>1.</b>	<b>5(4, 2, 0) i.e. best five answers from (a) – (f)</b>
(a) <i>Starch</i>	– polysaccharide (or explained) <b>or</b> polymer <b>or</b> correct test
<i>Glucose</i>	– monosaccharide (or explained) <b>or</b> monomer <b>or</b> correct test
(b) <i>Amino Acid</i>	– building block of protein <b>or</b> monomer <b>or</b> unit of protein
<i>Protein</i>	– polymer (of amino acids) <b>or</b> chain of (or many) amino acids
(c) <i>Cellulose</i>	– carbohydrate <b>or</b> polysaccharide <b>or</b> (found in plant) cell wall
<i>Keratin</i>	– protein <b>or</b> (found in human) hair (or nails or skin)
(d) <i>Enzyme</i>	– a catalyst (or explained)
<i>Hormone</i>	– a (chemical) messenger (or explained)
(e) <i>Biuret</i>	– (test for) protein
<i>Benedict's (Fehling's)</i>	– (test for) reducing sugar (or glucose or maltose)
(f) <i>Fats</i>	– (lipids) solid at room temp
<i>Oils</i>	– (lipids) liquid at room temp

<b>2.</b>	<b>6(3) + 2</b>
(a) First (level)	
(b) Primary consumer(s) <b>or</b> herbivore(s)	
(c) (Large) energy loss (from one level to next) <b>or</b> small energy transfer	
(d) Producers are large <b>or</b> primary consumers are parasites	
(e) (i) No	
(ii) (Parasites) are not producers <b>or</b> (parasites) are consumers (or explained)	
(f) Heat	

**3.**

**6(3) + (2)**

(a) X

Dog's body temperature is (relatively) stable **or** correct reference to graph

(b) Endothermic

(c) Respiration **or** metabolism **or** carbohydrate (or named carbohydrate) **or** fat (or named fat)

(d) (Temperature always suitable) for good enzyme activity **or** for metabolism **or**  
activity independent of environment

(e) Ectothermic

(f) Environment **or** the sun **or** metabolism

**4.**

**6(3) + (2)**

(a) 1. Bud(s) **or** node(s) **or** leaf

2. Vascular bundles [*plural only*]

(b) Vegetative propagation

(c) Diploid

Product of mitosis **or** genetically identical (to parent) **or** clone

(d) Fruit **or** (straw)berries **or** seeds

(e) Cuttings **or** layering **or** grafting **or** micro-propagation **or** tissue culture

**5.**

**1 + 1 + 8 + 6 + 4(1)**

- (a) (i) Only certain substances (or named substances) allowed through
- (ii) Substances can be kept in (or out) **or** substances can be let in (or out)
- (iii) Oxygen / glucose / water / amino acids / phosphate (or P) / iron **Any two**
- (b) (i) Pressure / of cell contents (or described) / on cell wall **Any two**
- (ii) Vacuole **or** cell wall **or** cell sap
- (iii) Support (or described)

**6.**

**1 + 1 + 8 + 6 + 4(1)**

- (a) (i) Each base has a (different) corresponding (or matching) (base)
- (ii) 1. Uracil **or** U
2. Guanine **or** G
- (iii) Ribose **or** deoxyribose
- (iv) Phosphate (group) **or** P
- (b) (i) Messenger
- (ii) RNA has ribose **or** RNA is single stranded
- or** DNA has deoxyribose **or** DNA is double stranded
- (iii) Joins nucleotides together (to give mRNA product) **or** to make RNA

**Section B**

**Best 2**

**2(30)**

<p><b>7.</b> (a) (i) Where an organism (or plant and animal) lives</p> <p>(ii) Organisms (interacting) with their environment</p>	<p><b>3</b></p> <p><b>3</b></p>
<p>(b) (i) Factor</p> <p>How investigated</p> <p>(ii) Key <b>or</b> (guide) book <b>or</b> illustrations</p> <p>(iii) Method described must demonstrate randomness</p> <p>(iv) Named animal + adaptation</p> <p>Named plant + adaptation</p> <p>(v) Named (species) of carnivore <b>or</b> of omnivore <b>or</b> of parasite</p> <p>(vi) Matching named prey</p>	<p><b>3</b></p> <p><b>3</b></p> <p><b>3</b></p> <p><b>3</b></p> <p><b>3</b></p> <p><b>3</b></p> <p><b>3</b></p> <p><b>3</b></p>

<p><b>8.</b> (a) (i) Product(s)</p> <p>(ii) Working at maximum rate</p>	<p><b>3</b></p> <p><b>3</b></p>
<p>(b) (i) Named enzyme</p> <p>Matching substrate</p> <p>(ii) Temperature <math>\geq 60^{\circ}\text{C}</math> for <math>\geq 5</math> min <b>or</b> boil / water bath <b>or</b> described / untreated enzyme / as control / no activity in denatured enzyme / (matching method of) observe activity / control result / named factor (kept constant) / how kept constant</p> <p>(iii) Any attempt</p>	<p><b>3</b></p> <p><b>3</b></p> <p><b>5(3)</b></p> <p><b>3</b></p>

9.	(a)	(i)	Avoidance of bias	3
		(ii)	Hypothesis can develop into a theory <b>or</b> explained	3
	(b)	(i)	1. $CO_2$ – vary $NaHCO_3$ conc.  <b>OR</b> <i>Light</i> – vary lamp (or plant) distance <b>or</b> vary lamp wattage	3
			2. Graph with labelled axes (rate on y-axis) + rise	3
		(ii)	1. As a selectively permeable membrane	3
			2. Change (increase or decrease) in mass (volume) <b>or</b> described	3
		(iii)	1. e.g. Iodine → yellow (or orange or brown)	3
			2. Dropper <b>or</b> use of filter paper	3
		(iv)	1. Milk agar <b>or</b> starch agar	3
			2. Boiled seeds	3

## Section C

## Best 4

4(60)

<p>10. (a) (i) *Endocrine</p> <p>(ii) Ductless</p> <p>(iii) Hormone (or insulin) secretion &amp; non-hormone (enzyme) secretions <b>or</b> has endocrine and exocrine function (or described)</p>	<p>3</p> <p>3</p> <p>3</p>
<p>(b) (i) Protein</p> <p>(ii) Hormone name</p> <p>1. Gland location</p> <p>2. Hormone function</p> <p>(iii) 1. Deficiency symptom</p> <p>2. Excess symptom</p> <p>3. Corrective measure</p> <p>(iv) Hormones travel in blood <b>or</b> are chemical</p> <p>Electrical transmission in nerves</p>	<p>3</p> <p>2(2)</p> <p>2(2)</p> <p>2(2)</p> <p>2</p> <p>2</p> <p>2</p> <p>3</p> <p>3</p>
<p>(c) (i) Made at one site &amp; function at another / transport slow / in vascular tissue <b>or</b> in blood and phloem (or xylem) / chemical (nature)</p> <p>(ii) e.g. IAA (auxin)</p> <p>Just behind shoot (or root) tip <b>or</b> meristem <b>or</b> zone of elongation</p> <p>(iii) Vascular bundles <b>or</b> vascular tissue <b>or</b> phloem <b>or</b> xylem</p> <p>(iv) (Encourage) rooting (in cuttings) / promote ripening / weed killer / seedless fruit / micro-propagation <b>or</b> tissue culture</p> <p>(v) IAA / auxin / ethene (ethylene) / abscissic acid</p>	<p>2(3)</p> <p>3</p> <p>3</p> <p>3</p> <p>2(3)</p> <p>3</p>

11.	<p>(a) (i) Fossils <b>or</b> embryology <b>or</b> anatomy <b>or</b> adaptation of plant or animal <b>or</b> genetics</p> <p>(ii) Any two points from evidence selected above:  <i>e.g. Fossils:</i> structure / changing / over time / related to environment  <i>e.g. Embryology:</i> different organisms / similar embryo / similar development pathways  <i>e.g. Anatomy:</i> Named structure / expansion point</p>	<p>3</p> <p>2(3)</p>						
	<p>(b) (i) Heterosomes <b>or</b> sex chromosomes</p> <p>(ii) Female <span style="margin-left: 150px;">Male</span>  </p> <p>(iii) <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td></td><td>X</td></tr> <tr><td>X</td><td>XX</td></tr> <tr><td>Y</td><td>XY</td></tr> </table> <span style="margin-left: 20px;">Gametes shown</span>  <span style="margin-left: 20px;">Cross shown</span>  <span style="margin-left: 20px;">F<sub>1</sub> genotypes shown</span></p> <p>(iv) 1. Gene(s) on sex <b>or</b> on X <b>or</b> on Y chromosome  2. Haemophilia / colour blindness</p>		X	X	XX	Y	XY	<p>3</p> <p>Male 3, 0 Female 3, 0</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>2(3)</p>
	X							
X	XX							
Y	XY							
	<p>(c) (i) *Interphase</p> <p>(ii) Replication <b>or</b> growth <b>or</b> protein synthesis <b>or</b> respiration <b>or</b> photosynthesis</p> <p>(iii) <i>Diagram:</i>  spindle (or outline of cell) + chromosomes on equator  + 6 double chromosomes</p> <p><i>Labels:</i>  Chromosome(s) / spindle / centromere(s) / cell membrane</p> <p>(iv) 1. Function  2. How function is carried out</p> <p>(v) Cancer</p>	<p>3</p> <p>3</p> <p>6, 3, 0</p> <p>3(1)</p> <p>3</p> <p>3</p> <p>3</p>						

12.	(a)	<p>(i) Composed of nucleic acid (or DNA or RNA) <span style="float: right;">3</span></p> <p>(ii) Can only replicate (or reproduce) inside a cell (or host) <span style="float: right;">3</span></p> <p>(iii) Genetic engineering <b>or</b> vaccine (production) <b>or</b> cancer treatment <b>or</b> pest control <b>or</b> disease control <span style="float: right;">3</span></p>
	(b)	<p>(i) *Monera <span style="float: right;">3</span></p> <p>(ii) 1 + 2 <i>Diagram:</i> wall + membrane + capsule + plasmid shown <span style="float: right;">5, 3, 0</span>  <i>Labels:</i> <span style="float: right;">4(1)</span></p> <p>(iii) 1. Harsh conditions <b>or</b> example <span style="float: right;">3</span>  2. DNA replicates / thick wall (or described) / encloses / shrinkage (or water loss) / of cytoplasm <span style="float: right;">2(3)</span></p> <p>(iv) *Saprophytic <span style="float: right;">3</span>  *Parasitic <span style="float: right;">3</span></p>
	(c)	<p>(i) <i>Antibodies</i> – proteins / produced by body / in response to antigen (or to infection) <span style="float: right;">4(3)</span>  <i>Antibiotics</i> – produced by micro-organisms / kill (or destroy or stop growth of) other micro-organisms / do not affect viruses</p> <p>(ii) Active - antibodies produced in body <span style="float: right;">3</span>  Passive – antibodies given <span style="float: right;">3</span></p> <p>(iii) Antibiotic resistance strains / more pathogens / more people (or poor hygiene) / patients weaker <span style="float: right;">2(3)</span></p>

13.	(a)	(i)	*Secondary sexual characteristics	3
		(ii)	*Puberty	3
		(iii)	*Testosterone	3
	(b)	(i)	A. Vagina B. Uterus (or womb) C. Endometrium (or lining of uterus or lining of womb) D. Fallopian tube (or oviduct) E. Ovary F. Cervix	6(1)
		(ii)	1. *E	3
			2. *D	3
			3. *C	3
		(iii)	<i>Oestrogen</i> : Endometrium repair / stimulates LH / inhibits FSH	2(3)
			<i>Progesterone</i> : Endometrium maintenance / inhibits LH / inhibits FSH	2(3)
	(c)	(i)	*Mitosis	3
		(ii)	*Blastocyst	3
		(iii)	Makes progesterone / barrier <b>or</b> one (barrier) example / material transfer <b>or</b> one (transfer) example	2(3)
		(iv)	(Mucus) show <b>or</b> contractions <b>or</b> waters break	3
		(v)	Contractions <b>or</b> amniotic sac breaks <b>or</b> cervix dilates	3
			Baby delivered	3
			Afterbirth delivered	3

<b>14.</b>	Any two of (a), (b), (c)	<b>(30, 30)</b>
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<b>14.</b>	(a)	(i)	*Light (dependent stage)	<b>3</b>
		(ii)	1. (electrons) picked up by acceptor / passed through carriers / back to chlorophyll / (electrons) lose energy	<b>2(3)</b>
			2. H <sub>2</sub> O split / protons to pool / NADP <sup>-</sup> formed / NADPH formed / (electrons) picked up by acceptor / passed through carriers / O <sub>2</sub> released / ATP produced	<b>2(3)</b>
		(iii)	*Dark (stage) (or *light-independent stage)	<b>3</b>
		(iv)	Light not needed	<b>3</b>
		(v)	Product (or named product) (of 1 <sup>st</sup> stage) required.	<b>3</b>
		(vi)	Sugar formed from CO <sub>2</sub>	<b>3</b>
			ATP provides energy <b>or</b> NADPH provides hydrogen (or H)	<b>3</b>

<b>14.</b>	(b)	<i>If any 'note' consists only of a word diagram, flow-chart or chemical equation, then a maximum of two scoring points may be awarded.</i>		
		(i)	<i>Metabolism:</i> (The sum of) all reactions in cell (or organism) / controlled by enzymes / catabolism explained <b>or</b> catabolism + example / anabolism explained <b>or</b> anabolism + example	<b>4 + 2(3)</b>
		(ii)	<i>Krebs Cycle:</i> occurs in second stage of respiration / in mitochondria / when O <sub>2</sub> present (or aerobic) / starts with Acetyl Co-enzyme A / ATP produced / hydrogen (pairs) produced <b>or</b> energised electrons / CO <sub>2</sub> produced	<b>4 + 2(3)</b>
		(iii)	<i>ADP:</i> Adenosine di-phosphate / a low energy (molecule) / + phosphate (P) / + energy / ATP formed	<b>4 + 2(3)</b>

<p><b>14.</b> (c) (i) Anaerobic respiration</p> <p>(ii) Yeast</p> <p>(iii) *Fungi</p> <p>(iv) Any named carbohydrate</p> <p>(v) 1. <i>Bioprocessing:</i> using micro-organisms (or enzymes) to form product(s)</p> <p style="padding-left: 40px;"><i>Immobilised:</i> fixed to inert material (or named material) <b>or</b> fixed to each other <b>or</b> trapped in gel (or named material)</p> <p>2. Can be re-used (or recovered) <b>or</b> pure product (or described)</p> <p>3. Alginate</p> <p>4. Bioreactor</p>	<p><b>3</b></p>
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<b>15.</b>	Any two of (a), (b), (c)	<b>(30, 30)</b>
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<b>15.</b>	(a)	(i)	Finch (or sparrow) + (blood sucking) mites	<b>3</b>
		(ii)	(Organism living on) host (or explained) / causing damage	<b>2(3)</b>
		(iii)	Disease <b>or</b> death <b>or</b> weakened (birds)	<b>3</b>
		(iv)	Readily available <b>or</b> shortage of normal material <b>or</b> similar to normal building material <b>or</b> suitable material <b>or</b> insulator	<b>3</b>
		(v)	Repulsion (or described) <b>or</b> attraction (or described)	<b>3</b>
		(vi)	Tar <b>or</b> nicotine (or other named substance) <b>or</b> bacteria	<b>3</b>
		(vii)	By weighing it	<b>3</b>
		(viii)	Control (or explained)	<b>3</b>
		(ix)	No (mite)-repelling (or mite-killing) chemicals <b>or</b> absence of named chemical	<b>3</b>

<b>15.</b>	(b)	(i)	<ul style="list-style-type: none"> <li>• Nitrogen gas to usable compounds /</li> <li>• Plant protein to animal protein /</li> <li>• Excretion releasing N compounds /</li> <li>• Death and decomposition /</li> <li>• Dead organic matter to ammonium</li> <li>• Ammonium to nitrite /</li> <li>• Nitrite to nitrate /</li> <li>• Nitrates to plant protein /</li> <li>• Nitrogen compounds to nitrogen gas /</li> <li>• One example of bacterial involvement /</li> <li>• Role of lightning</li> </ul>	<i>Any six</i>	<b>6(2)</b>
		(ii)	Fixation (or explained) / bacteria (or micro-organisms) involved / death and decay / nutrition (or described) / excretion		<b>2(2)</b>
		(iii)	To be able to detect change(s) <b>or</b> to remedy effect of change <b>or</b> to detect levels of pollutants (or example)		<b>2</b>
		(iv)	1. <i>Contest:</i> one gets all (of the resource)		<b>2</b>
			<i>Scramble:</i> all get some (of the resource)		<b>2</b>
			2. <i>Edaphic:</i> to do with soil		<b>2</b>
			<i>Aquatic:</i> to do with water		<b>2</b>
			3. <i>Climate:</i> long-term (prevailing) conditions		<b>2</b>
			<i>Weather:</i> short-term (atmospheric) conditions		<b>2</b>

<b>15.</b>	<b>(c)</b>	<b>(i)</b>	<i>Graph:</i>	Out of sync.	<b>3</b>
				Most prey peaks higher than predator peaks	<b>3</b>
		<b>(ii)</b>		Explanation of time lag	<b>3</b>
				Explanation of bigger prey numbers	<b>3</b>
		<b>(iii)</b>		Yes (or No) + explanation	<b>3</b>
		<b>(iv)</b>		Population control	<b>3</b>
		<b>(v)</b>		Name predator 1	<b>3</b>
				Adaptative technique	<b>3</b>
				Name predator 2	<b>3</b>
				Adaptative technique	<b>3</b>

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