



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2025**

Life and Health Sciences

Assessment Unit AS 5

assessing

Material Science

[SZ051]

THURSDAY 5 JUNE, AFTERNOON

**MARK
SCHEME**

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations.

Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

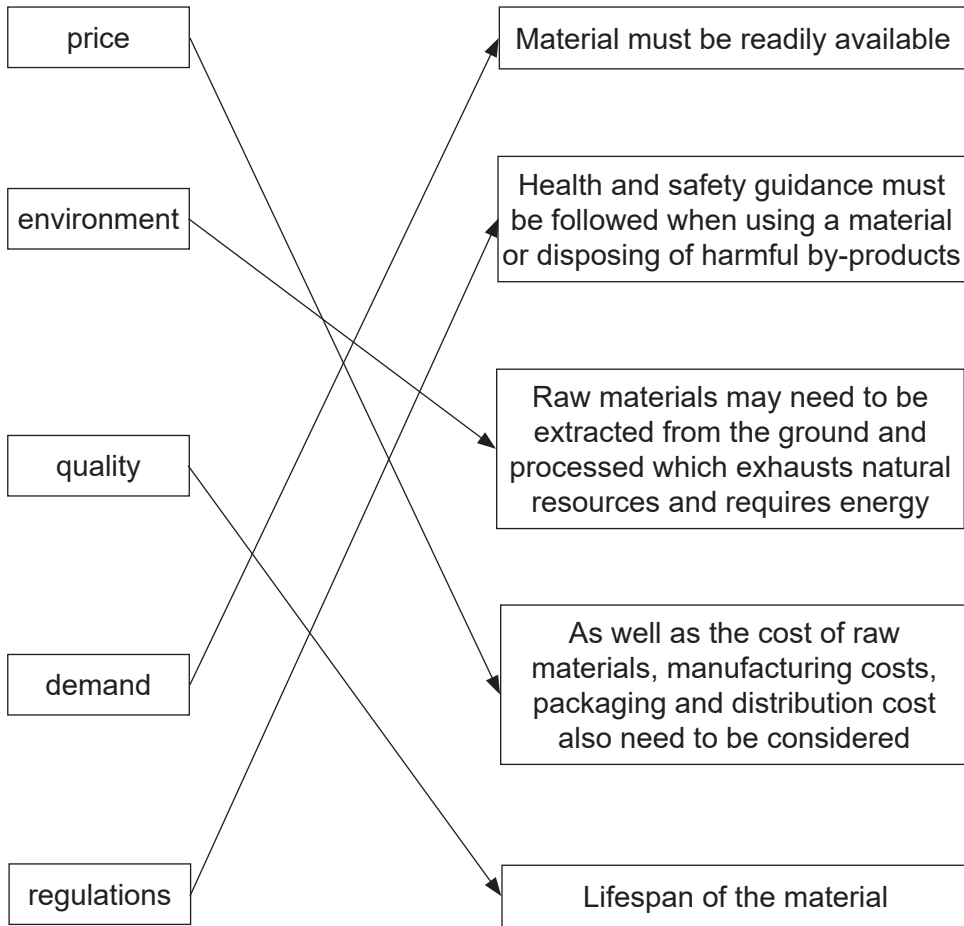
The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

Where one response is required to gain a mark, candidates will not gain credit if a correct response is given alongside one or more incorrect responses. This is referred to as listing.

1 (a)



[1] each

[4]

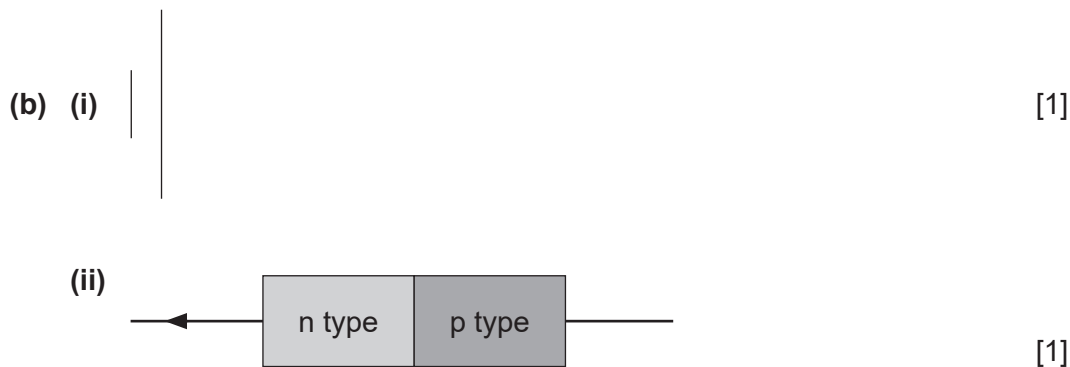
- (b) (i) square based pyramid [1]
the angles between opposite faces is 136° [1] [2]
- (ii) diamond [1]
- (iii) 10 – 15 seconds [1]
- (iv) lengths of the two diagonals of the indentation/ The area of the sloping surface [1]
- (v) The harder the material the smaller the indentation/area/diameters [1]
- (vi) ability to withstand scratches/dents/wear/risk of failure [1]

AVAILABLE MARKS

11

- 2 (a) Contains free electrons [1]
Layers cannot slide past each other [1] [2]
- (b) (i) monomers [1]
(ii) thermosetting plastics have crosslinks and thermoplastics don't [1]
(iii) thermoplastics (threshold for 3rd mark) [1]
can be remoulded [1]
by heating [1] [3]
- (c) Particles have no regular arrangement/pattern/structure [1]
- (d) (i) Vibrations are confined to a single plane [1]
perpendicular to the direction of the light propagation [1] [2]
(ii) enhances image quality/contrast [1]

- 3 (a) (i) two electrons in inner shell, eight electrons in second shell [1]
three electrons in outer shell [1] [2]
(ii) nucleus [1]
(iii) no free electrons [1]
(iv) p type (threshold) [1]
When bonded with 4 silicon atoms [1]
A hole is created [1] [3]



4

Smart material	Property that changes	External conditions	Use
Electroluminescent material	Produce light	small current applied	Night light/watch illumination/computer monitors/LED/back lighting
Quantum-tunnelling composites	Becomes conductive	Pressure/force/squeezed	Touchscreen/pressure sensor

[1] each

[6]

AVAILABLE MARKS

11

9

6

5	(a)	(i) A mixture of two or more elements (threshold) of which at least one is a metal	[1] [1]	[2]
		(ii) Heat to a high temperature/above recrystallisation temperature Cool (slowly) to below recrystallisation temperature	[1] [1]	[2]
		(iii) easier to cut/easier to shape/more malleable/more ductile		[1]
	(b)	Steel contains carbon	[1]	
		Stainless steel contains chromium	[1]	[2]
	(c)	(i) bronze		[1]
		(ii) nichrome		[1]
		(iii) nichrome		[1]
		(iv) Area = πr^2 or $\pi d^2/4$ or volume formula or subs 8.04 × 10 ⁻⁸ (m ²) 1.21 × 10 ⁻⁷ (m ³)	[1] [1] [1]	[3]
		(v) mass = density × volume 1.21 × 10 ⁻⁷ × 8730 ecf 1.05 × 10 ⁻³ (kg)	[1] [1] [1]	[3]

**AVAILABLE
MARKS**

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- 6 (a) (i) both made from carbon atoms arranged in a hexagonal shape [1]
 Graphene is one atom thick sheet
 Graphite is more than one atom thick [1] [2]
- (ii) diameter between 1 and 100 nm [1]
- (iii) graphene [1]
- (iv) Rolled into a cylinder/tube [1]

(b) **Indicative content**

- Hollow
- Small
- Needle like shape
- large surface area

- nitric oxide sensors
- selective cancer cell destruction
- bio-stress sensors
- glucose detection biosensors
- scaffolding for tissue regeneration

- lung inflammation
- lung cancer
- unexpected immune response
- nanotoxicity

Response	Marks
Candidates describe clearly 5 or more of the points shown in the indicative content. There is widespread and accurate use of appropriate scientific terminology. Presentation, spelling, punctuation and grammar are excellent. They use the most appropriate form and style of writing. Relevant material is organised with clarity and coherence.	[5]–[6]
Candidates describe clearly 3 or 4 of the points shown in the indicative content. There is good reference of scientific terminology. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear. They use an appropriate form and style of writing. There is some attempt to organise material.	[3]–[4]
Candidates identify clearly 1 or 2 of the points shown in the indicative content. There is limited reference of scientific terminology. Presentation, spelling, punctuation and grammar may contain some errors. The form and style are of a satisfactory standard. There is only a limited attempt to organise material.	[1]–[2]
Response is not worthy of credit	[0]

[6]

11

AVAILABLE
MARKS

7 (a) (i) stress = F/A
 $300/1.13 \times 10^{-7}$
 2.65×10^9 (must be 3sf)
Pa

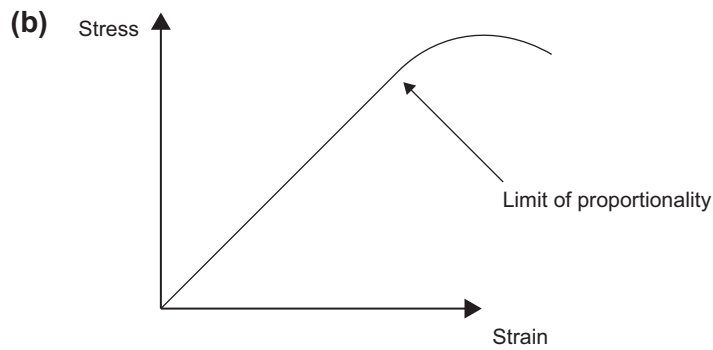
[1]
[1]
[1]
[1] [4]

(ii) strain = extension/length
 $5/250$
0.02

[1]
[1]
[1] [3]

(iii) $E = \text{stress/strain}$
 $2.65 \times 10^9 / 0.02$ ecf
 1.33×10^{11} Pa

[1]
[1]
[1] [3]



[1]

Total

**AVAILABLE
MARKS**

11

75