



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2024**

Life and Health Sciences

Assessment Unit AS 5

assessing

Material Science

[SZ051]

THURSDAY 6 JUNE, MORNING

**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

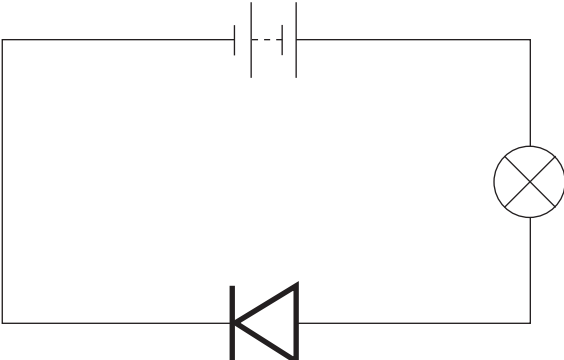
Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

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.

- 1 (a) (i) The ability of a material to withstand chemical attack [1]
- (ii) Chromium [1]
- (iii) Pure metals too soft/Pure metals are made harder by adding another element (making it an alloy)/An alloy is made so that its properties are better suited to a particular purpose than the pure metal [1]
- (iv) Composite
Combines the properties of two (or more) materials to form a better, more useful (improved) product/one with better properties/provides additional tensile strength [2]
- (b) (i) Material D – Opaque or brittle [1]
- (ii) Material B – Ductile or good electrical conductivity [1]
- 2 (i) A material inserted into the body as part of an implanted medical device [1]
- (ii) Bioinert: A material which is not rejected by the body/does not release toxins/does not interact with biological tissue in the body
- Bioactive: A material which interacts with or causes a chemical/biological response when in contact with living tissue
- Biotolerant: A material which is not rejected when implanted into living tissue [3]
- (iii) Bioglass = bioactive
Silicone = biotolerant
Titanium = bioinert [3]
- 3 (a) (i) 2, 8, 4
(first shell = 2, second shell = 8, third shell = 4) [2]
(award 1 for correct outer shell only)
- (ii) Doping
e.g. phosphorus and aluminium
Accept any named element from GpIII and/or GpV [3]
- (b) (i)  [1]
- (ii) Region where there are no charge carriers [1]
- (iii) Reduces/gets smaller [1]

AVAILABLE
MARKS

7

7

8

4 (i) $\sigma = 2/0.5 \times 1 \times 10^{-6}$
 $= 4 \times 10^6$
 Unit: $\Omega^{-1}\text{m}^{-1} / \text{Sm}^{-1}$ [3]

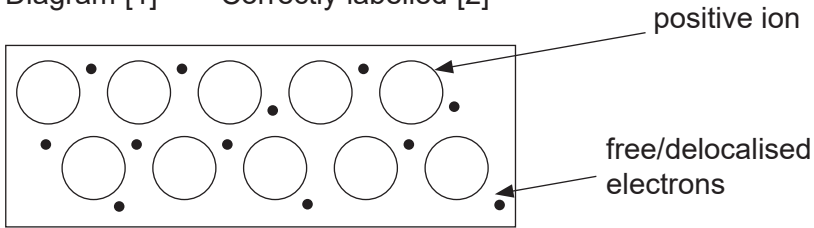
(ii) Conductivity now $\frac{1}{4}$ of original value/reduced/less than/decreased [1]

5 (a)

Electron	Shells/Orbitals	-1
Neutron	<i>Nucleus</i>	Neutral/ no charge/0
Proton	Nucleus	+1

[1] for each correct row [3]

(b) Diagram [1] Correctly labelled [2]



[3]

(c) A = Amorphous
 B = Crystalline [1]

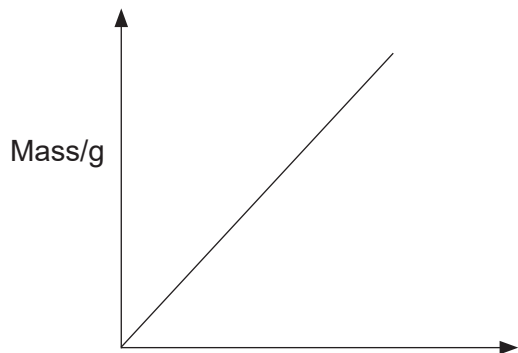
(d)

	Thermosetting plastics	Thermoplastics
Weak intermolecular forces		✓
No crosslinks		✓
Strengthen when heated	✓	
Cannot be remoulded after they are initially formed	✓	
Heat resistant	✓	
uPVC		✓

$\frac{1}{2}$ each round down per row [3]

10

6 (i)



y-axis labelled correctly [1] with units [1]

y-axis scale [1]

Points plotted correctly (± 1 sq)/3+ points correct [1]

Straight line through the origin [1]

[5]

(ii) Density = gradient or $\Delta y/\Delta x$

$$= 2.7 \text{ (gcm}^{-3}\text{)}$$

[3]

Suitable values chosen for the best fit line

(iii) First material (or converse)(2.7 gcm^{-3}) is more dense than second material (0.862 gcm^{-3})

Less (dense)

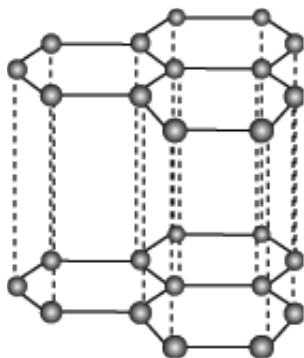
[1]

AVAILABLE
MARKS

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7 (i) Structure of graphite

[2]

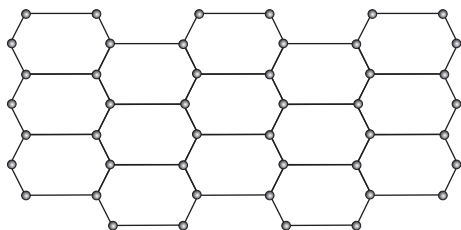


Atoms arranged in hexagons
(minimum 2 per layer)

With one layer parallel above
other

Structure of graphene

[1]



Atoms arranged in hexagons
in a single thick layer

[3]

(ii) Graphite: layers of carbon atoms

Graphene: one atom thick layer of graphite

Carbon nanotubes: sheet of graphene curved into a closed cylinder/
one atom thick sheet of graphene arranged in a closed cylinder

[3]

(iii) Any **one** from:

High surface area to volume ratio

Hollow (to allow for delivery of drugs)

High tensile strength

High thermal and electrical conductance

[1]

(iv) Benefit: less harm to the rest of the body/target specific site/non-toxic/
unreactive/smaller doses needed/penetrates membranes easily

Risk: possible side effects/long term effects not yet known/body may
reject it/can end up where you don't want them

[2]

(v) $3 \times 10^{-9} \text{ m}$

[1]

AVAILABLE
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- 8 (a) (i) Stress: Force applied per unit cross section area of a material (or equation in words) [1]
- (ii) Strain: Extension per unit length of a material (or equation in words) [1]

(b) (i) **Indicative content:**

Measurement and equipment

Measure force (using a) newton metre (or alternative)

Measure diameter (using a) micrometer screw gauge

Measure length (using a) metre rule

Measure extension (using a) travelling microscope/mm scale/vernier scale

Reliability

Repeat readings/find average

Accuracy

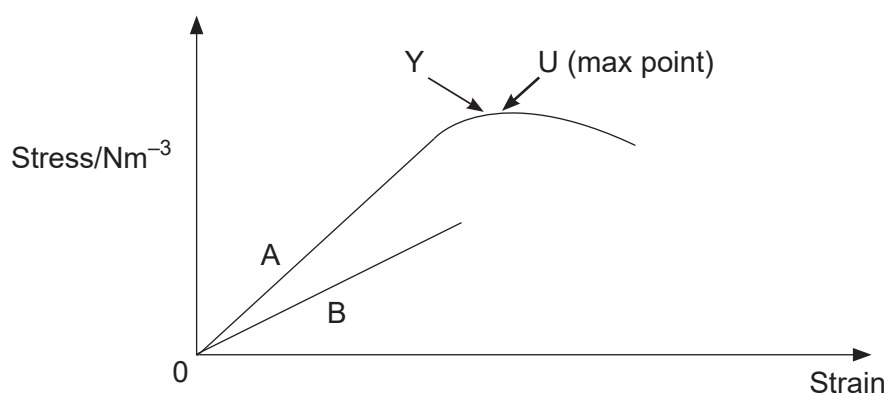
Use a long length of wire/ensure no kinks in wire/constant temperature

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]

- (ii) Material A (threshold)
Higher value of Young Modulus than B [2]

(iii)



1 for correct curve

[1]

