

Properties of Materials

Q1. (2018)

3		A ✓	1	1.1	
---	--	-----	---	-----	--

Q2. (2018)

14		C ✓	1	1.1	
----	--	-----	---	-----	--

Q3. (2018)

23		Any three from: Mendeleev's table has no noble gases or Group 8 or Group 0 / ORA ✓ Mendeleev's table has no transition elements / ORA ✓ Mendeleev's table has gaps (left for elements to be discovered) / no gaps in modern-day table / AW ✓ (Mendeleev's table ordered by atomic mass whereas modern-day table ordered by atomic number) ✓ Mendeleev's table doesn't have atomic number (whereas modern-day table does) ✓ Mendeleev swapped iodine and tellurium to reflect chemical properties ✓	3	3 x 1.1	ALLOW Mendeleev's table only has 7 groups / ORA ALLOW reference to specific elements missing from Mendeleev's table eg gallium / germanium
----	--	--	---	---------	---

Q4. (2019)

3		D ✓	1	1.1	
---	--	-----	---	-----	--

Q5. (2019)

7		B ✓	1	1.1	
---	--	-----	---	-----	--

Q6. (2019) – 16b, 16c

A)

	(b)	Low density and idea that aircraft is lightweight / isn't too heavy to fly / less weight to carry / AW ✓ High strength and idea that aircraft is less likely to be damaged ✓	2	3.2b	DO NOT ALLOW light / lighter for low density but ALLOW so aircraft is light or lighter Answers must give property and explanation for marks BUT ALLOW 1 mark for low density and high strength / strongest if no or only one explanation given
--	-----	--	---	------	--

B)

	(c)	(i)	(Percentage of lithium =) $(2 \div 10) \times 100 = 20(\%)$ ✓	1	3.1a	
--	-----	-----	---	---	------	--

C)

		(ii)	Idea that alloy B is only 2.2% lithium / Idea that alloy B is 2.2% lithium but the diagram has 20% lithium / Idea that the % of lithium in the alloy is much smaller than in the diagram / there should be 100 aluminium atoms (and 2 lithium atoms) ✓	1	3.2a	ALLOW ECF from incorrect percentage in (c)(i) ALLOW should be more Al atoms / 17.8% too large IGNORE references to the relative sizes of the atoms
--	--	------	--	---	------	---

A)

17	(a)	Could be breathed in / Idea of absorbed by skin / Idea of absorbed into bloodstream / Take a long time to break down in the environment ✓	1	2.1	ALLOW cannot see so may leave (areas of) skin unprotected ALLOW idea that we don't know the long term risks IGNORE idea that they are not fully understood / there could be side effects / idea that they may react with or irritate skin / harmful to humans
----	-----	---	---	-----	--

	(b)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.12 OR 0.12:1 OR 1:8.3 award 4 marks Surface area = $6 \times 50^2 = 15000$ ✓ Volume = $50^3 = 125000$ ✓ Surface area / volume ratio = $15000 \div 125000$ ✓ = 0.12 or 0.12:1 or 1:8.3 ✓	4	3 x 2.2	Units not needed
					ALLOW surface area = $1.5 \times 10^4 \text{ nm}^2$ ALLOW volume = $1.25 \times 10^5 \text{ nm}^3$ ALLOW ECF from incorrect surface area and/or volume 1.2 ALLOW any simplified ratio consistent with 0.12:1 eg 3:25 or 1.5:12.5 for 4 marks DO NOT ALLOW ratio wrong way round eg 1:0.12

		(c) (i) Nanoparticles have diameter between 1 - 100 (nm) / idea that (diameter of) DNA is more than 1 (nm) but less than 100 (nm) ✓ Water (molecule) is too small / 0.27 (nm) is less than 1 (nm) / idea that 0.27 (nm) is not in range 1 – 100 (nm) ✓	2	1.1	ALLOW has at least one dimension on the nanoscale
--	--	---	---	-----	--

		(ii) FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3100 award 2 marks 100000 ÷ 32 ✓ = 3100 (2 significant figures) ✓	2	2.2	ALLOW 3125 for 1 mark ALLOW 0.00032 for 1 mark (correct sig figs from incorrect working out, ie 32 ÷ 100000)
--	--	---	----------	------------	---

A)

19	(a)	(i)	C ✓ Low density and good electrical conductor ✓	2	3.2a 1.1	Second mark is dependent on correct choice of C BOTH properties required for second mark IGNORE good conductor DO NOT ALLOW light / lighter for low density
----	-----	-----	--	---	-----------------	--

		(ii)	Idea of a feature of a substance that can be observed or measured ✓	1	1.1	ALLOW a specific example eg the appearance of something or the state (of matter) or melting point / boiling point IGNORE idea of a property that is reversible
--	--	------	---	---	-----	--

	(b)	Dissolve gas or oxide in water / make a solution of the oxide ✓ Test with universal indicator (paper) ✓ (universal indicator) would turn blue / pH greater than 7 ✓	3	3.3a	ALLOW shake gas or oxide with water ALLOW use a pH meter / pH probe ALLOW test with (damp) red litmus (paper) ALLOW (damp red litmus paper) turns blue
--	-----	--	---	------	---

Q9. (2020)

4	D ✓	1	1.1	
---	-----	---	-----	--

Q10. (2020)

A)

17	(a)	Any two from: In order of (increasing) atomic mass / weight ✓ In groups showing similar <u>chemical</u> properties ✓ Left gaps for elements that had not been discovered ✓	2	1.1	ALLOW (increasing) mass number IGNORE just in order of mass
----	-----	---	---	-----	--

B)

	(b)	In order of (increasing) atomic number / proton number ✓	1	1.1	IGNORE electrons DO NOT ALLOW atomic mass
--	-----	--	---	-----	--

C)

	(c)	(i)	Germanium ✓	1	3.1a	
--	-----	-----	-------------	---	------	--

D)

		(ii)	Idea of similar atomic mass / 72.6 is closest to 72 / closest atomic mass ✓ Idea of similar density / 5.35 is closest to 5.5 / closest density ✓	2	2 x 3.2a	ALLOW (Relative) atomic mass of 72.6 is very close to 72 IGNORE just atomic masses are 72 and 72.6 ALLOW density of 5.35 is very close to 5.5 IGNORE just densities are 5.35 and 5.5 IGNORE comments about melting point or colour If no marks awarded, ALLOW 1 for density and relative atomic mass and not melting point
--	--	------	---	---	----------	---

Q11. (2021)

8	C ✓	1	1.1	
---	-----	---	-----	--

Q12. (2022)

2	B ✓	1	1.2	
---	-----	---	-----	--

Q13. (2022)

10	B ✓	1	1.1	
----	-----	---	-----	--

Q14. (2022)

15	A ✓	1	2.1	
----	-----	---	-----	--

Q15. (2022) – 22c

A)

	(c)	(i)	B and D ✓	1	2.1	BOTH required for the mark
--	-----	-----	-----------	---	-----	----------------------------

B)

	(ii)	B ✓ (B is) a nanoparticle so it has a large surface area to volume ratio ✓ Idea that (B is) cheap and has a high purity ✓	3	3 x 3.2a	No marks awarded if B not given ALLOW B (is the smallest particle so) has the <u>largest</u> surface area to volume ratio
--	------	---	---	----------	---

Q16. (2023)

3	D	1	2.1	
---	---	---	-----	--

Q17. (2023)

4	C	1	1.1	
---	---	---	-----	--

Q18. (2023)

A)

21	(a)	(Substance) 3 ✓ And any two from: Polymers have low melting points / substance 3 has a low melting point ✓ Polymers do not conduct electricity / substance 3 does not conduct electricity ✓ Polymers can be flexible / substance 3 is flexible ✓	3	3 x 2.1	(Substance) 1 or 2 scores 0 for the question IGNORE references to boiling point ALLOW maximum 1 mark for a correct explanation if Substance 4 is chosen
----	-----	---	---	---------	---

B)

	(b)	Idea that polymer <u>chains</u> without cross-links can slide or move over each other / ORA ✓ The intermolecular forces holding polymer <u>chains</u> together are weaker than cross-links / ORA ✓	2	2 x 1.1	Assume unqualified answer refers to polymers without cross-links IGNORE references to the polymer chains stretching ALLOW idea that cross-links are covalent bonds
--	-----	---	---	---------	---

C)

	(c)	(Part A) - substance 3 AND (Part B) – substance 1 ✓ Explanations Part A needs to be an insulator / Part A needs to protect from electrical shock / Part A needs to be flexible (so wire can bend) ✓ Part B needs to conduct electricity ✓	3	3 x 3.2a	DO NOT ALLOW named substances (e.g., plastic / metal) for MP1 ALLOW Part A does not conduct electricity MP2 and MP3 are independent of MP1
--	-----	---	---	----------	--

Q19. (2024)

1	C	1	1.1	
---	---	---	-----	--

Q20. (2024)

8	A	1	1.1	
---	---	---	-----	--

Q21. (2024)

A)

16	(a)	(i)	First check the answer on the answer line If answer = 7.5 : 1 award 2 marks $1.5 \div 0.2 = 7.5 \checkmark$ $0.2 \div 0.2 = 1 \checkmark$	2	2 x 2.1	If no answer given on answer line, check table. ALLOW 15:2 for 1 mark
----	-----	-----	--	---	---------	---

B)

	(a)	(ii)	As the surface area to volume ratio <u>increases/gets larger</u> , the tablet will take <u>less</u> time to dissolve $\checkmark$ OR As the surface area to volume ratio <u>decreases/gets smaller</u> , the tablet will take <u>more</u> time to dissolve $\checkmark$	1	3.1a	ALLOW shorter for less time IGNORE faster for less time ALLOW longer for more time IGNORE slower for more time
--	-----	------	--	---	------	---

C)

	(a)	(iii)	(Tablet D) has the highest / higher surface area <u>to volume ratio</u> $\checkmark$ So it will take less / least time to dissolve / dissolves faster / fastest $\checkmark$	2	2 x 3.1b	No mark for no; marks are for explanation Answer must be comparative ALLOW (Tablet D) has the highest / higher <u>ratio</u> ALLOW Tablet D does not have smallest surface area <u>to volume ratio</u> so will not dissolve slowest $\checkmark$ Tablet C will dissolve slowest as has smallest surface area to volume ratio $\checkmark$
--	-----	-------	---	---	----------	--

Q22. (2024) – 20b

	(b)		(Formulation) B $\checkmark$ B has highest melting point / ORA / B is solid at the highest temperature $\checkmark$	2	2 x 3.2a	MP2 is dependent on MP1 ALLOW idea that B has the highest temperature before it changes state
--	-----	--	---	---	----------	--