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Question 3 (Answer: **C**)

- For a neutral atom, electrons = protons, and neutrons = nucleon number − protons.
- Na: $23 - 11 = 12$ neutrons; Na^+ has one electron fewer, so 10.
- O: $16 - 8 = 8$ neutrons; O^{2-} has two electrons more, so 10.

Question 5 (Answer: **B**)

- Neutrons = nucleon number − proton number.
- W: $40 - 20 = 20$. X: $41 - 20 = 21$. Y: $37 - 18 = 19$. Z: $37 - 17 = 20$.
- So W and Z both have 20 neutrons – charge makes no difference to the neutron count.

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Question 5 (Answer: **C**)

- Mass number counts protons *and neutrons*, not protons twice.
- Al^{3+} has lost three electrons, so its configuration is $2, 8$, not $2, 8, 3$.
- The common isotope of hydrogen is the only atom with no neutron at all.

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Question 3 (Answer: **D**)

- The nucleons are the particles in the nucleus: protons and neutrons.
- So the nucleon number is the total of the two together.
- Protons alone is the *proton* number, and electrons are not in the nucleus at all.

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<table>
<tr><td>1(a)</td><td>
<table>
<tr><td>particle</td><td>relative mass</td><td>relative charge</td></tr>
<tr><td>proton</td><td>1</td><td></td></tr>
<tr><td>neutron</td><td>1</td><td>0 / nil</td></tr>
<tr><td>electron</td><td></td><td>– 1</td></tr>
<tr><td></td><td>✓(1)</td><td>✓(1)</td></tr>
</table>
</td></tr>
<tr><td>1(b)(i)</td><td>M1 atoms of the same element that have the same number of protons
M2 but different numbers of neutrons</td></tr>
<tr><td>1(b)(ii)</td><td>they have the same number of electrons and therefore the same electronic configuration</td></tr>
<tr><td>1(c)</td><td>M1 22
M2 16 and 18
M3 50 and 22 and to the left of the symbol
M4 Ti
M5 2+</td></tr>
<tr><td>1(d)</td><td>nucleon number</td></tr>
<tr><td>1(e)</td><td>M1 mol Ar = 2.0 ÷ 40 = 0.05 (mol)
M2 number of atoms = 0.05 × 6.02 × 10^{23} = 3.01 × 10^{22}</td></tr>
</table>

Question 3 (Answer: **A**)

- Zinc's proton number is 30, and a neutral atom has the same number of electrons.
- Its relative atomic mass is 65, so neutrons $= 65 - 30 = 35$.
- Protons and electrons must be equal in an atom, which rules out the other rows.

Question 4 (Answer: **B**)

- $2, 8, 8$ means 18 electrons altogether.
- Argon has 18, and Cl^- has $17 + 1 = 18$.
- Al^{3+} has 10 and Na^+ has 10, so both are $2, 8$ instead.

2(a)

M1 charge (1)	**M2** mass(1)
–1	
	1
+1	1

1 mark for each correct column

2(b)(i)

electron	neutron	proton
19	20	19
18	22	19

1 mark for each correct column

2(b)(ii) **M1** $(41 \times 10) + (39 \times 90) = 3920$ (1)

M2 $(3920 \div 100) = 39.2$(1)

2(b)(iii) aluminium has only 1 isotope which has nucleon number 27

2(c) **M1** Ar (1)

M2 P^{3-} or S^{2-} or Cl^- (1)

Question 4 (Answer: **B**)

- S^{2-} has $16 + 2 = 18$ electrons, that is $2, 8, 8$.
- Argon also has 18 electrons, so it matches.
- A calcium *atom* has 20 and O^{2-} has 10, so only one of the three matches.