



IB Chemistry – SL

Topic 2 Answers

1. A [1]
2. B [1]
3. A [1]
4. C [1]
5. A [1]
6. D [1]
7. C [1]
8. D [1]
9. D [1]
10. A [1]
11. B [1]
12. C [1]
13. B [1]
14. D [1]
15. A [1]
16. B [1]
17. B [1]
18. D [1]
19. B [1]
20. C [1]



[1]

21. B

[1]

22. D

[1]

23. C

[1]

24. D

[1]

25. A

[1]

26. A

[1]

27. A

[1]

28. A

[1]

29. (a) mole ratio C:H = $\frac{85.6}{12.01} : \frac{14.4}{1.01} = 7.13:4.3$;

No penalty for using integer atomic masses.

empirical formula is CH₂;

2

(b) (i) number of moles of gas n = $\frac{PV}{RT} = \frac{\text{mass}}{\text{molar mass}} ; \frac{1.01 \times 10^2 \text{ kPa} (0.399 \text{ dm}^3)}{8.314 \frac{\text{J}}{\text{mol K}} (273 \text{ K})}$;

$$\frac{1.00 \text{ g}}{0.017 \text{ mol}} = 56.3 \text{ (g mol}^{-1}\text{)}$$

2

OR

molar mass is the $\frac{\text{mass of the molar volume}}{22.4 \text{ dm}^3}$ at STP;

$$= \frac{1.00 \times 22.4}{0.399} = 56.1 \text{ (g mol}^{-1}\text{)}$$

Accept answers in range 56.0 to 56.3.

Accept two, three or four significant figures.

(ii) C₄H₈;

1

No ECF.

[5]

30. 7 protons, 8 neutrons, 10 electrons;

2

Award [2] for three correct and [1] for two correct.



[2]

31. (a) (i) ionization, acceleration, deflection/separation; 2
Award [1] for all three names and [1] for correct order.
Award [1] for two names in correct order.
- (ii) ionization: sample bombarded with high-energy or high-speed electrons/*OWTTE*;
acceleration: electric field/oppositely charged plates;
deflection: (electro)magnet/magnetic field; 3
- (b) (i) average or (weighted) mean of masses of all isotopes of an element;
relative to (one atom of) ^{12}C ; 2
Both marks available from a suitable expression.
- (ii) $A_r = (70 \times 0.2260) + (72 \times 0.2545) + (74 \times 0.3673) + (76 \times 0.1522)$;
 $= 72.89$; 2
No other final answer acceptable.
Award [2] for correct final answer.

[9]

32. (i) number of protons in the nucleus/atom; 1
Do not accept protons and electrons.
- (ii) number of protons and neutrons in the nucleus/atom; 1

[2]

33. Si 2.8,4/2,8,4;
 P^{3-} 2.8,8/2,8,8; 2

[2]

34. 16 protons and 17 neutrons and 18 electrons; 1

[1]

35. Al – 2,8,3;
N – 2,5;
F – 2,7; 2

Award [2] for three correct, [1] for two or one correct.

Accept correct configuration using s,p,d notation.

[2]

36. $A_r(\text{Cl}) = 35.45 = \frac{35x + 37(100 - x)}{100}$; 2
- $^{35}\text{Cl} = 77.5\%$ and $^{37}\text{Cl} = 22.5\%$; 2

[2]

37. (a) (i) to produce positively charged ions;
by the bombardment of fast moving electrons; 2



- (ii) magnetic field at right angles to path of ions/accept suitably labelled diagram;
moves ions in curve path/deflects ions;
dependent on mass/charge ratio; 2
Award [1] each for any 2 points.
- (iii) acceleration of the ions by electric field/towards negative plate/cathode; 1
- (b) (i) atoms with the same number of protons/positive charges/atomic number but different number of neutrons/mass number; 1
- (ii) $A_r(\text{Rb}) = 85.47 = \frac{85x + 87(100-x)}{100}$;
Accept other valid mathematical alternatives.
 $^{85}\text{Rb} = 76.5$ and $^{87}\text{Rb} = 23.5\%$; 2
- (iii) mass; density;
boiling point;
melting point;
rate of diffusion in the gas phase;
enthalpy of vaporization;
enthalpy of fusion;
rate of reaction in the gas/liquid phase; 1
Any two for one mark
- (iv) Si: $1s^2 2s^2 2p^6 3s^2 3p^2$;
 Fe^{3+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$;
 P^{3-} : $1s^2 2s^2 2p^6 3s^2 3p^6$; 3
Allow [1 max] for 3 correct abbreviated structures using noble gas symbols.
38. (i) ratio of average mass of an atom to $\frac{1}{12}$ the mass of C-12 isotope/
average mass of an atom on a scale where one atom of C-12 has a mass of 12/sum of the weighted average mass of isotopes of an element compared to C-12/OWTTE; 1
Award no mark if 'element' is used in place of 'atom'
- (ii) ^{63}Cu (more abundant) since $A_r(\text{Cu})$ is closer in mass to 63; 1
Explanation needed for mark
- [2]
39. (a) atom of same element/same number of protons but with different mass number/number of neutrons; 1



- (b) protons 23
 electrons 23
 neutrons 27
Three correct [2], two correct [1]. 2

- (c) ${}_{23}^{51}\text{V}$ /51 nearer to A_r value of 50.94; 1

- (d) carbon, $12/{}^{12}\text{C}$; 1
 [5]

40. (a) mass/density/for gases: rate of effusion or diffusion/melting point/
 boiling point 1
Do not accept mass number.

- (b) if ${}^{35}\text{Cl} = x$, then $(x = 35.00) + (1 - x) 37.00 = 35.45$
Award [1] for set up.
 therefore, $x = 0.775$; 2
 ${}^{35}\text{Cl} = 77.5\%$ and ${}^{37}\text{Cl} = 22.5\%$;
(need both for mark);

[3]

41. (a) atoms of the same element/same number of protons/same atomic number;
 having different numbers of neutrons/different (mass number); 2
*Award only [1] max if reference made to elements but
 not atoms.*

- (b) relative atomic mass = $\frac{36 \times 0.337 + 38 \times 0.0630 + 40 \times 99.6}{100}$; 2

- (c) 23 electrons;
 26 protons;
 30 neutrons; 2
Award [2] for three correct, [1] for two correct.

[6]

42. (a)

	an atom of ${}^{79}\text{Br}$	an ion of ${}^{81}\text{Br}^-$	
protons	35	35	;
neutrons	44	46	;
electrons	35	36	;

3

- (b) ${}^{79}\text{Br}$ because A_r is closer to 79/OWTTE; 1

- (c) (i) 2,8,8,2/2.8.8.2; 1

- (ii) CaBr_2 ; 1

[6]



43. (a) 12 protons and 13 neutrons and 11 electrons; 1
- (b) electric field/oppositely charged plates/potential difference/*OWTTE*; 1
- (c) $^{25}\text{Mg}^+$;
greater m/z value/less highly charged ions need stronger fields to deflect them/*OWTTE*; 2
Do not accept greater mass with no reference to charge, or greater mass and smaller charge.
44. (a) $\text{IV} < \text{I} < \text{II} < \text{III}$ /
ultra violet radiation < yellow light < red light < infrared radiation; 1 [4]
- (b) A continuous spectrum has all colours/wavelengths/frequencies whereas a line spectrum has only (lines of) sharp/discrete/specific colours/wavelengths/frequencies; 1
- (c) UV-B radiation has shorter wavelength;
hence, has higher energy;
increases risk of damage to skin cells/*OWTTE*/causes cancer; 3 [5]