

## Relative Formula Mass

## Q1. (2019) – 3d

| Question number | Answer                                                                                                                                                              | Additional guidance                                                                                     | Mark |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------|
| 3(d)            | <b>MP1 : calculation</b><br>$24\,600 \times 42$ (1) (=1 033 200)<br><br><b>MP2 : answer to 3 sig figs</b><br>$= 1\,030\,000 / 1.03 \times 10^6$ (1) (to 3 sig figs) | without working:<br>$1\,030\,000$ – 2 marks<br>$1\,033\,200$ – 1 mark<br><br>allow $24600/42 = 586$ (1) | (2)  |

## Q2. (2019) – 8c (ii)

| Question number | Answer                                                                                                                                                                                                                                                          | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                 | Mark |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 8(c)(ii)        | 82.8 with or without working scores 3<br>correct answer but incorrectly rounded or not to 3sf scores 2<br><br>$4 \times 12$ (1) (= 48)<br>OR<br>$\frac{100}{58}$ (= 1.724...) (1)<br>$58$<br><br>$48 \times 100$ (1) (= 82.759)<br>$58$<br><br>$= 82.8$ (g) (1) | allow ecf but calculation must use 12, 58, 100<br><br>if working rounded to 1dp and carried forward, allow full marks<br>eg $1.72 \times 48 = 82.56$ (2) or $82.6$ (3)<br><br>allow<br>$\frac{100}{58}$ (1) (= 1.72414)<br>$58$<br>$= 1.72$ (1) (to 3 sf)<br>OR<br>$\frac{100}{58} \times 12$ (= 20.68966)<br>$58$<br>$= 20.7$ (1) (to 3 sf)<br>OR<br>$4 \times 12$ (1) $\times 100$ (= 4800)<br>$= 4.80 \times 10^3$ (1) (to 3 sf) | (3)  |

## Q3. (2019) – 9b

| Question number | Answer                                                                                                                                                                                                                                                                                                                                                                          | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Mark |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 9(b)            | 2.25/ 2.3 with or without working scores 3<br><br>$\text{MgO} = 24 + 16 = 40$ (1)<br><br><b>THEN</b><br>$1 \text{ g Mg forms } \frac{40}{24}$ (1) = 1.67 (g) MgO<br><br>$1.35 \text{ g Mg forms } \frac{40 \times 1.35}{24}$ (1) MgO<br>$= 2.25$ (g)<br><br><b>OR</b><br>$\text{Mg} \quad \frac{1.35}{24}$ (1) = 0.05625<br>$\text{MgO} \quad 0.05625 \times 40$ (1) = 2.25 (g) | allow ecf for incorrect formula mass<br><br>allow<br>$48 \text{ g Mg forms } 80 \text{ g MgO}$ (1)<br>(could be under the equation)<br><b>THEN</b><br>$1 \text{ g Mg forms } \frac{80}{48}$ (1) = 1.67 g MgO<br><br>$1.35 \text{ g Mg forms } \frac{80 \times 1.35}{48}$ (1) MgO<br>$= 2.25$ (g)<br><br><b>OR</b><br>$\text{Mg} \quad \frac{1.35}{48}$ (1) = 0.028125<br>$\text{MgO} \quad 0.028125 \times 80$ (1) = 2.25 (g)<br><br>Note $40 \times 1.35 = 54$ (2) or $80 \times 1.35 = 108$ (2) | (3)  |

## Q4. (2020) – 3a (ii)

| Question number | Answer                                                                              | Additional guidance                         | Mark |
|-----------------|-------------------------------------------------------------------------------------|---------------------------------------------|------|
| 3(a)(ii)        | (mass conserved because) the numbers are the same/nothing is lost/nothing is gained | allow same mass / same weight / same amount | (1)  |

## Q5. (2020) – 7c (ii)

| Question number | Answer                                                                                                                                                                                                                                                                                                                                                                                     | Mark |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 7(c)(ii)        | <p><b>C</b> <math>4/60 \times 100</math></p> <p><b>C</b> is the only correct answer.</p> <p><b>A</b> is incorrect because there are four atoms of hydrogen in ethanoic acid</p> <p><b>B</b> is incorrect because there are four atoms of hydrogen in ethanoic acid</p> <p><b>D</b> is incorrect because the fraction is inverted and there are four atoms of hydrogen in ethanoic acid</p> | (1)  |

## Q6. (2021) – 4d

| Question number | Answer                                                                                                       | Mark                         |
|-----------------|--------------------------------------------------------------------------------------------------------------|------------------------------|
| 4(d)            | <p><math>\frac{63.5}{159.5}</math> (= 0.39811912) (1)</p> <p>0.398 x 100 (= 39.811912) (1)</p> <p>40 (1)</p> | <p>(3)</p> <p><b>AO2</b></p> |

## Q7. (2021) – 10b (iv)

| Question number | Answer                                                                                                                                             | Additional guidance                                                                                                    | Mark                         |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 10(b)(iv)       | <p>relative formula mass <math>C_2H_3Cl</math> = 62.5 (1)</p> <p><math>2850 \times 62.5</math> (1) (=178125)</p> <p>178000 (to 3 sig figs) (1)</p> | <p>without working</p> <p>178000 (3)</p> <p>178125 /178127 (2)</p> <p>allow ECF on incorrect relative formula mass</p> | <p>(3)</p> <p><b>AO2</b></p> |

## Q8. (2022) – 5a (iii)

| Question number | Answer                                                                                                                                                 | Mark                           |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 5(a)(iii)       | <p><b>C</b> 44 is the only correct answer.</p> <p><b>A</b>, <b>B</b> and <b>D</b> are incorrect because <math>3 \times 12 + 8 \times 1 = 44</math></p> | <p>(1)</p> <p><b>AO2 1</b></p> |

## Q9. (2022) – 6b (iii)

| Question number | Answer                                                                                                                                                                                                                                                                                                                                      | Additional guidance                                                                                                                                                                                                                                                                           | Mark         |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 6(b)(iii)       | iron = 43 <b>and</b> chlorine = 82 scores 3 with or without working<br><br>$34.4 \times 125$ (1)<br>100<br><br>= 43 given as mass of iron (1)<br><br>$125 - 43 = 82$ given as mass of chlorine (1)<br><br>OR<br><br>$65.6 \times 125$ (1)<br>100<br><br>= 82 given as mass of chlorine (1)<br><br>$125 - 82 = 43$ given as mass of iron (1) | one correct and one incorrect (or missing) value with or without working scores 2<br><br>allow ECF<br><br>allow ECF but must add up to 125g for MP3<br><br>allow ECF but must add up to 125g for MP3<br><br>allow final answers reversed on answer lines for 2 marks with or without working. | (3)<br>A02 1 |

## Q10. (2022) – 7c (ii)

| Question number | Answer                                                                                                                                                                                                                           | Additional guidance                                                                                                                                                                                                                                                                | Mark         |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 7(c)(ii)        | $4.52304 \times 10^{-18}$ with or without working scores 2<br><br><ul style="list-style-type: none"> <li><math>6.98 \times 10^{-23} \times 64800</math> (1)</li> <li><math>= 4.52(304) \times 10^{-18}</math> (g) (1)</li> </ul> | do not award $4.52304 \times 10^{-18}$ (but could score MP1 if this is correctly shown)<br><br>Allow 2-6 sig fig.<br><br>MP2 scores for correct evaluation of a division including the two pieces of data ONLY:<br>$1.07716 \times 10^{-27}$ (1)<br>$9.2836... \times 10^{26}$ (1) | (2)<br>A02 1 |

## Q11. (2022) – 9c

| Question number | Answer                                                                                                                                                                           | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Mark         |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 9(c)            | $2.20$ with or without working scores (2)<br><br><ul style="list-style-type: none"> <li><math>5(.000) - 2.8(00) = 2.2(00)</math> (1)</li> <li><math>= 2.20</math> (1)</li> </ul> | reject additional processing for MP1 (e.g $5 - 2.8 = 2.2$ then $\frac{2.2}{100} = 0.0220$ )<br><br>does not score MP1 – additional process of dividing by 100<br>does not score MP2 – using a number not in the question<br><br>for MP2 final answer must be to 3sf, correct evaluation of expression using only numbers from the question<br><br>$2.2 / 2.200$ scores 1 mark<br>$\frac{5.000}{2.800} = 1.79$ scores 1 mark<br>$\frac{2.800}{5.000} = 0.560$ scores 1 mark [ $0.56 = 0$ ]<br>$5.000 \times 2.800 = 14.0$ scores 1 mark [ $14 = 0$ ]<br>$5.000 + 2.800 = 7.80$ scores 1 mark [ $7.8 = 0$ ] | (2)<br>A02 1 |

## Q12. (2023) – 5e

| Question number | Answer                                                                                                                                                                                                                                                                                                                                       | Additional guidance                                                                                                                               | Mark         |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 5(e)            | $\frac{92}{180} = 0.5111111$ (1)<br>$0.5111111 \times 45 = 23$ (g) (1)<br>OR<br>$\frac{180}{92} = 1.956$ (1)<br>$\frac{45}{1.956} = 23$ (1)<br>OR<br>$\frac{180}{45} = 4$ (1)<br>$\frac{92}{4} = 23$ (1)<br>OR<br>$\frac{45}{180} = 0.25$ (1)<br>$92 \times 0.25 = 23$ (1)<br>OR<br>$92 \times 45 = 4140$ (1)<br>$\frac{4140}{180} = 23$ (1) | answer of 23 (g) alone scores (2)<br>allow any number of sig figs on step 1 except 1<br><br>for any method calculation, allow ecf from MP1 to MP2 | (2)<br>AO2-1 |

## Q13. (2024) – 6d

| Question number | Answer                                                                                                                                                                                                                         | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                         | Mark         |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 6(d)            | mass of potassium = 164 (g) <b>AND</b><br>mass of bromine = 336 (g)<br>with or without working scores 3<br><br>potassium :<br>$\frac{32.8}{100} \times 500$ (1)<br>$= 164$ (g) (1)<br><br>bromine :<br>$500 - 164 = 336$ g (1) | mass of potassium = 164 (g) <b>OR</b><br>mass of bromine = 336 (g)<br>with or without working scores 2<br><br>If answers on answer line are the wrong way round with or without working, score 2 marks<br><br>If 164 or 336 appear on the incorrect final answer line, score 1<br><br>ecf for correct evaluation of a percentage<br><br>for bromine allow $100 - 32.8 = 67.2$<br>$\frac{67.2}{100} \times 500 = 336$<br>100 | (3)<br>AO2 1 |

## Q14. (2024) – 7a (iii)

| Question number | Answer                                                                                                                                                                                                                      | Additional guidance                 | Mark         |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------|
| 7(a)(iii)       | $7.67415 \times 10^{-18}$ with or without working scores 2<br><br><ul style="list-style-type: none"> <li><math>82500 \times 9.302 \times 10^{-23}</math> (1)</li> <li><math>= 7.67415 \times 10^{-18}</math> (1)</li> </ul> | allow 2 or more significant figures | (2)<br>AO2 1 |

## Q15. (2024) – 9b

| Question number | Answer                                                                                                                                                                                                         | Additional guidance                                                                                                                                                                                                                                                         | Mark         |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 9(b)            | 48.942 with or without working scores (2)<br><br><ul style="list-style-type: none"> <li><math>0.529 \times \frac{4.200}{2.100} = 1.058</math> (1)</li> <li><math>50.000 - 1.058 = 48.942</math> (1)</li> </ul> | 48.94 or 48.9 (with or without working) scores 2<br>49 rounded from 48.942 scores 2<br>49 rounded from 49.471 scores 1<br>49 with no or other working scores 0<br><br>allow $0.529 \times 2 = 1.058$<br><br>allow ecf for 50 – calculated mass of oxygen<br>49.471 scores 1 | (2)<br>AO2 1 |

## Q16. (2024) – 10c

| Question number | Answer                                                                                                                    | Additional guidance                                                                                                | Mark         |
|-----------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------|
| 10(c)           | 85 with or without working scores 2<br><br>$\text{CO}_3 = 12 + 3 \times 16 = 60$ (1)<br><br>$\frac{230 - 60}{2} = 85$ (1) | final answer of<br>85 2 marks<br>170 1 mark<br><br>allow ecf for MP2 from C+ O value worked out<br>using 12 and 16 | (2)<br>AO2 1 |