GCSE
CHEMISTRY

Topic Paper: 3 Quantitative chemistry
Part 1 & 2 Mark Scheme

MARK SCHEME

75 Marks

M1. (a) (i) (phosphoric) acid

allow phosphoric

1

(ii) H^+ / hydrogen (ion)

if ion symbol given, charge must be correct

1

(b) (i) pencil

1

so it will not run / smudge / *dissolve*

ignore pencil will not interfere with / affect the results

or

because ink would run / smudge / *dissolve*

ignore ink will interfere with / affect the results

1

(ii) any **three** from:

*reference to spots / dots = max **2***

allow colouring for colour
3 colours in Cola

*allow more colours in cola **or** fewer colours in fruit drink*
2 colours in Fruit drink
one of the colours is the same
two of the colours in Cola are different
one of the colours in Fruit drink is different

allow some of the colours in the drinks are different
one of the colours in Cola is the most soluble

accept one of the colours in Cola has the highest R_f value

3

(c) different substances travel at different speeds **or** have different retention times

accept different attraction to solid

ignore properties of compounds

1

(d) (i) Is there caffeine in a certain brand of drink?

1

(ii) any **two** from:

cannot be done by experiment
based on opinion / *lifestyle choice*
ethical, *social* or economic issue

accept caffeine has different effects on different people

2

[11]

M2. (a) (i) 40

*correct answer with or without working **or** incorrect working*
*if the answer is incorrect then evidence of 24 + 16 gains **1** mark*
ignore units

2

(ii) 60

*correct answer with **or** without working or incorrect working*
*if the answer is incorrect then evidence of 24/40 **or** 24/(i) gains **1** mark*
ecf allowed from part(i)
ie 24/(i) ×100
ignore units

2

(iii) 15

ecf allowed from parts(i) and (ii)
24/(i) ×25 or (ii)/100 ×25
ignore units

1

(b) (i) any **two** from:

ignore gas is lost

error in weighing <u>magnesium</u> / <u>magnesium oxide</u>
allow some magnesium oxide left in crucible

loss of magnesium oxide / magnesium
allow they lifted the lid <u>too much</u>
allow loss of reactants / products

not all of the magnesium has reacted
allow not heated enough
allow not enough oxygen / air

2

(ii) any **two** from:

ignore fair test

check that the result is not anomalous

to calculate a mean / average
allow improve the accuracy of the mean / average

improve the reliability
allow make it reliable

<u>reduce</u> the effect of errors

2

[9]

M3. (a)

$$^{2}_{1}H$$

2 and 1 must be on the left
2 must be above half-way on the H and the 1 below half-way
accept diagram with 2 <u>different</u> particles in centre and 1 particle on circle

1

(b) (i) 18

ignore working
ignore units

1

(ii) forces (of attraction) between molecules **or**
bonding between molecules **or**
intermolecular forces /intermolecular bonds

1

are weak **or** not much energy needed to break them **or** easily overcome

must be linked to first mark
*if no other mark awarded allow <u>small</u> molecules / small M_r for **1** mark*
*allow forces / bonds are weak for **1** mark*
*do **not** allow covalent bonding is weak*

1

(c) *any reference to <u>more</u> protons = **0** marks*

H-2 atoms have 1 proton and 1 neutron

*allow H-2 has more neutrons / particles for **1** mark*

1

H-1 atoms have one proton

*allow H-2 has two particles and H-1 has one particle for **1** mark*

or

H-2 atom has one neutron (1)

*allow H-2 atom has one more neutron for **2** marks*

H-1 atom has no neutrons (1)

***NB** heavy water (molecule) has 2 <u>more</u> neutrons = **2** marks*
*heavy water (molecule) has <u>more</u> neutrons / particles = **1** mark*
*if no other mark awarded then heavy water molecule has **M_r** of 20 = **1** mark*
ignore reference to electrons

1

[6]

M4. (a) 152 correct answer with **or** without working = **2 marks**
56 + 32 + (4 ×16) gains **1** mark
ignore any units

2

(b) 152g(rams)
ecf from the answer to (a) and g
must have unit g / gram / gramme / grams etc
*accept g / mol **or** g per mole **or** g mole^{-1} **or** g/mol **or** g per mol **or** g mol^{-1}*
*do **not** accept g m*
*do **not** accept G*

1

(c) 76(g)
ecf from their answer to (a) or (b) divided by 2
ignore units

1

[4]

M5. (a) (i) column

1

(ii) mass spectrometer

1

(b) (i) 165
*if answer is not correct then evidence of correct working gains **one** mark.*
e.g. (10 ×12) + 15 + 14 + 16

2

(ii) 10.37%
accept 10 / 10.4 / 10.37.....
*if answer is not correct then evidence of correct working gains **one** mark.*
e.g. minimum evidence would be 14/135

2

(c) any **two** from:

faster

more accurate

detects smaller amounts

2

(d) to avoid bias

accept to check / compare the result

1

to improve reliability

1

[10]

M6. (a) 100

ignore units
*40 + 12 + (3 ×16) for **1** mark*

1

(b) 40

*(**ecf** from part (a) can get **2** marks)*

$\frac{40}{\text{their (a)}} \times 100$ *for **1** mark*

1

(c) 0.5

*(**ecf** from part (b) can get **2** marks)*

$1.25 \times \left(\frac{\text{their (b)}}{100}\right)$ ***or** other correct working for **1** mark*

2

(d) gas produced **or** carbon dioxide / CO_2 produced

1

[7]

M7. (a) same number/six electrons;
same number/six protons;
react in same way **not** same element or both carbon

any two for 1 mark each

2

(b) different number of neutrons
gains 1 mark

but **or**

$^{14}_{6}C$ has two more neutrons different mass number
gains 1 mark

or

but two mass units bigger
gains 2 marks

$^{14}_{6}C$ has 8 neutrons while $^{12}_{6}C$ has 6 neutrons
gains 2 marks

2

[4]

M8.

(a) Fe_2 [56 ×2] **or** 112
O_3 [16 ×3] **or** 48
each gain 1 mark

but M_r = 160
gains 3 marks

3

(b) $[Fe_2O_3 + 2A1 \rightarrow 2Fe + A1_2O_3]$

160 → 112 (NB Credit if unworked
(or value (or value but should be totalled)
from (a)) from (a))
gains 1 mark

but
32 g. of Fe_2O_3 → 32/160 × 112
gains 2 marks

but = 22.4
gains 3 marks

3

[6]

M9. 70/56 30/16
division by atomic mass

1

= 1.25 = 1.875

proportion

1

2 3

ratio (accept 1:1.5 / 4:6 / etc)
allow e.c.f from proportion if sensible attempt at step 1

1

Fe_2O_3

formula allow e.c.f from ratio if sensible attempt at step 1
*allow correct formula with no working = **1** mark*

1

[4]

M10. (a)

$\frac{6.21}{207}$ $\frac{0.64}{16}$

***1** mark for dividing mass by A_r*
*max **2** if A_r divided by mass*

1

= 0.03 = 0.04

***1** mark for correct proportions*

1

3 4

***1** mark for correct whole number ratio (allow multiples) can be awarded from correct formula*

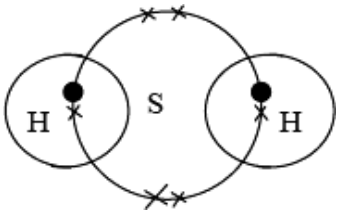
1

Pb_3O_4

***1** mark for correct formula*
ecf** allowed from **step 2 to step 3** and **step 3 to step 4** if sensible attempt at **step 1
*correct formula with no working gains **2** marks*

1

(b) (i)



*allow all dots **or** all crosses **or** e **or** e^-*
ignore inner shells and any inner electrons
allow 4 non-bonded electrons anywhere on shell as long as not in overlap – need not be paired

1

(ii) forces of attraction / bonds between molecules are weak (owtte)

*do **not** accept intramolecular forces / covalent bonds are weak*

*do **not** accept reference to ions*

or

intermolecular forces / bonds are weak (owtte)

or

it is made of small molecules with weak forces of attraction

*if **2** marks not awarded*

*made of small molecules / simple molecular gains **1** mark*

*forces of attraction are weak (without specifying between molecules / intermolecular) gains **1** mark*

(accept easily broken / not much energy needed to break instead of weak)

bonds are weak without specifying intermolecular would not gain a mark and would be ignored

2

(iii) 4

1

[8]

M11. (a) 130.4

accept 130 to 130.43478…..

correct answer gains two marks with or without working

*an answer of 131 would gain **one** mark.*

if answer is not correct then:
moles of salicylic acid = 0.7 ..... (1 mark)
or
mass of aspirin = moles of salicylic acid x 180 (1 mark)
or
100 x (180/138) (1 mark)

2

(b) (i) 62.5%

accept 63%

correct answer gains two marks with or without working

if answer is not correct then:
250/400 x 100 (1 mark)

2

(ii) any **one** from:

reversible reaction

accept not all of the reactant converted to product

some of product lost

1

(c) use lower temperatures
or
less energy needed

allow product made faster or more product made in a given time

1

[6]