

MASTER CLASS

CHEMISTRY

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THE PAPER

3 HOURS

ANY 8 QUESTIONS OUT OF 11 TO COMPLETE. This year you can answer ANY 8 QUESTIONS.

50 MARKS EACH

22.5 MINUTES EACH

SECTION A - 3 QUESTIONS

QUESTION 1

VOLUMETRIC ANALYSIS – 8 mandatory experiments

This topic is always examined in this section. The good news is that there is quite a large amount of common material in each of the experiments.

Every year they examine **general practical procedures** which are roughly the same for each experiment that you do. For example how to prepare a solution in a volumetric flask and how to use a pipette, burette and conical flask. I strongly advise that you put effort into this.

Every year there are **calculations** to do. Also be familiar of the types of calculations that are asked in each experiment. For example, if it is a bleach or vinegar experiment they will ask for the concentration as $\%(w/v)$, in an iron tablet experiment it'll be percentage of iron (II) in the tablet(s). Understanding of concentration of solutions is essential here.

Finally, you should take time to ensure you know the different **unique or specific questions** that go with each experiment. For example, why is sulfuric acid used at two different stages in the iron tablet experiment

or why was the bleach/vinegar diluted before use in these experiments.

QUESTION 2

ORGANIC CHEMISTRY EXPERIMENT(S) – 7 mandatory experiments

These are divided into 4 **preparations** (ethene, ethyne, soap and benzoic acid) and 3 **techniques** (steam distillation with solvent extraction, chromatography and recrystallisation with finding the melting point).

Each experiment is different but I would go through this check list.

1. Any **diagram** showing the apparatus needed.
2. Any balanced **equations** needed.
3. **Safety procedures** unique to the experiment including hazard symbols.
4. If a technique, what **principle** is involved.
5. Any **calculations** needed e.g. determining limiting reactant and percentage yield.
6. Any **tests** being carried out on the preparations, e.g. combustion, tests for unsaturation, tests to show the presence of an aldehyde or carboxylic acid.
7. **Observations** - Physical appearances of the materials used, effervescence, flame colours, colour changes.

QUESTION 3 - USUALLY ON ONE (OR MORE) OF THE REMAINING 12 MANDATORY EXPERIMENTS (BUT HAS BEEN A SECOND ORGANIC EXPERIMENT ON TWO OCCASIONS).

The common experiments to appear here are:

Rates of reaction experiments (usually involving drawing graphs and interpreting graphs).

Water- Colorimetry and Suspended and dissolved solids.

Heat of reaction of an acid with a base.

Gas laws – determining the Mr of a volatile liquid.

Tests for anions and flame tests appeared in this question.

SECTION B

There are 8 questions in section B. Three of which have an internal choice, 4, 10 and 11.

QUESTION 4

Three words. PRACTISE, PRACTISE, PRACTISE.

Topics here usually include

Atomic theory

Organic chemistry

Stoichiometry

Definitions

Acids/bases

Water

QUESTION 5

ATOMIC THEORY generally one of three topics

*Electronegativity and bonding including shapes of molecules

*Atomic radius and Ionization energies

*Scientists involved in the history of the periodic table and history of the atom/Radioactivity.

QUESTION 6

FUELS AND HEATS OF REACTION

Crude oil, natural gas, petrol.

Hess's law using heats of combustion and heats of formation.

This is a good one to prepare in advance of the exam as it is quite repetitive

QUESTION 8 OR 9

GENERAL ORGANIC CHEMISTRY

Drawing and naming organic molecules from 8 homologous series. THIS IS SO IMPORTANT!

Reactions types and reagents and conditions involved in the conversion of one homologous series to another.

Mechanisms of free radical substitution and ionic addition reactions, with evidence.

QUESTION 10

THREE PARTS, PICK TWO

QUESTION 11

FOUR PARTS, PICK TWO

In questions 10 and 11 there is usually **more organic chemistry and more atomic theory**. This is also where there may be a stoichiometry problem to solve. Any other topic can appear in these questions. Part (d) of question 11 will be examining the option.

OTHER IMPORTANT TOPICS – there is usually a full question and a half question (minimum) on these areas of the syllabus.

CHEMICAL EQUILIBRIUM

RATES OF REACTION

WATER

ALLOCATION OF MARKS IN THE MAIN AREAS

Organic chemistry - 150 to 200 marks

Atomic theory - 81 marks

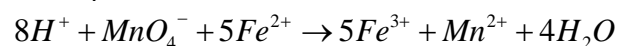
Volumetric analysis – 50 marks

Then chemical equilibrium, rates of reaction and water will give one full question and at least one half question (but more likely more) – 75 marks

QUESTION 1 CALCULATION EXAMPLE

The following experiment was carried out to find the mass of iron in an iron tablet. A 250 cm^3 volume of solution containing five tablets dissolved in dilute sulfuric acid was carefully made up in a volumetric flask. The molarity of this solution was found by titrating it in 25 cm^3 volumes against a 0.005 M solution of potassium manganate (VII) which had been previously standardised. The potassium manganate (VII) solution was put in the burette and a number of titrations were carried out. The average titration figure was 17.5 cm^3 .

The equation for the reaction is:



Calculate the moles of KMnO_4 added from the burette.

Calculate the moles of Iron (II) that this amount of KMnO_4 reacted with.

Hence find the mass of iron (II) in one tablet and the percentage of iron (II) per tablet.

HESS' LAW CALCULATION EXAMPLE (Q6 USUALLY)

Write the balanced equation for the complete combustion of butane in an adequate supply of oxygen.

Calculate the heat of combustion of butane, given that the heats of formation of carbon dioxide, water and butane are -393.5 , -285.8 and $-125.7 \text{ kJ mol}^{-1}$, respectively.

SOME REACTION TYPES IN ORGANIC CHEMISTRY

COMBUSTION

FREE RADICAL SUBSTITUTION REACTION

IONIC ADDITION REACTIONS

ELIMINATION REACTIONS

CONDENSATION REACTION – Esterification reaction

BASE HYDROLYSIS REACTION