Miss McCall's Science Exam Guide -

Science Exam Structure-

All Combined Double Exams are 1 hour 15 minutes – All Triple Exams are 1 hour 45 minutes

In May you will have 3 Science Exams:

1. **Biology Paper 1** **2. Chemistry Paper1** **3. Physics Paper 1**

In June you will have a further 3 Science Exams:

1. **Biology Paper 2** **2. Chemistry Paper 2** **3. Physics Paper 2**

Section 1- What is the question asking you to do? Straight from your exam board AQA…

Command words (Science)

Command words are the words and phrases used in exams that tell students how they should answer a question. Words marked * are new from 2016.

Calculate

Students should use numbers given in the question to work out the answer.

Choose*

Select from a range of alternatives.

Compare

This requires the student to describe the similarities and/or differences between things, **not just write about one.**

Complete

Answers should be written in the space provided, for example, on a diagram, in spaces in a sentence or in a table.

Define*

Specify the meaning of something. If you cannot remember, recall an equation of check the equation sheet.

Describe

Students may be asked to recall some facts, events or process in an accurate way.

Design*

Set out how something will be done.

Determine*

Use given data or information to obtain and answer.

Draw

To produce, or add to, a diagram.

Estimate

Assign an approximate value.

Evaluate

Students should use the information supplied as well as their knowledge and understanding to consider evidence **for and against**. This should also include a **judgement/conclusion.**

Explain

Students should make something clear, or state the reasons for something happening.

Give

Only a short answer is required, not an explanation or a description.

Identify*

Name or otherwise characterise.

Justify

Use evidence from the information supplied to support an answer.

Label

Provide appropriate names on a diagram.

Measure*

Find an item of data for a given quantity.

Name

Only a short answer is required, not an explanation or a description - a single word, phrase or sentence.

Plan*

Write a method.

Plot*

Mark on a graph using data given.

Predict*

Give a plausible outcome.

Show*

Provide structured evidence to reach a conclusion.

Sketch*

Draw approximately.

Suggest

This term is used in questions where students need to apply their knowledge and understanding to a new situation.

Use

The answer must be based on the information given in the question. Unless the information given in the question is used, no marks can be given. In some cases students might be asked to use their own knowledge and understanding.

Work out*

Students should use numbers given in the question to work out the answer.

Write

Only a short answer is required, not an explanation or a description.

Biology – Core Practicals

Section 2- What are the Biology topics you have studied and which have core practicals to learn…

AQA Topics	**AQA Chapter**	**Core Practicals**	**Year Taught**	**Exam Paper**
Cell Structure and Transport	B1 Chapter 1	B1.2 B1.8	9	1
Cell Division	B1 Chapter 2		10	1
Organisation & the Digestive System	B1 Chapter 3	B3.3 B3.6	9	1
Organising plants and animals	B1 Chapter 4		10	1
Communicable Diseases	B2 Chapter 5	*B5.4 Triple*	10	1
Preventing and treating disease	B2 Chapter 6		10	1
Non-communicable disease	B2 Chapter 7		10	1
Photosynthesis	B2 Chapter 8	B8.2	9	1
Respiration	B2 Chapter 9		9	1
The Human Nervous system	B3 Chapter 10	B10.2	10	2
Hormonal Coordination	B3 Chapter 11	*B11.9 Triple*	11	2
Homeostasis in action (Triple only)	*B3 Chapter 12*		11	2
Reproduction	B4 Chapter 13		11	2
Variation and Evolution	B4 Chapter 14		11	2
Genetics and Evolution	B4 Chapter 15		11	2
Adaptations and Interdependence	B5 Chapter 16	B16.3	9	2
Organising an Ecosystem	B5 Chapter 17	*B17.4 Triple*	11	2
Biodiversity and Ecosystems	B5 Chapter 18		11	2

	Required practical	Topic
1	**Using a light microscope.** Use a light microscope to observe, draw, and label a selection of plant and animal cells and include a scaled magnification.	B1.2
2	**Investigating the effect of antiseptics or antibiotics on bacterial growth.** Use agar plates and measure the zones of inhibition produced around colonies.	B5.4
3	**Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.** Investigate osmosis by measuring how the mass of plant tissue changes in a range of concentrations of salt or sugar solutions.	B1.8
4	**Use standard food tests to identify food groups.** Detect sugars, starch, and proteins in food using Benedict's test, the iodine test, and Biuret reagent.	B3.3
5	**Investigate the effect of pH on the rate of reaction of amylase enzyme.** Students should use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values.	B3.6
6	**Investigate the effect of light intensity on the rate of photosynthesis** Use an aquatic plant to observe the effect light intensity has on the rate of photosynthesis.	B8.2
7	**Investigate the effect of a factor on human reaction time.** Plan and carry out an investigation, choosing appropriate ways to measure reaction time and considering the risks and ethics of the investigation.	B10.2
8	**Investigate the effect of light or gravity on the growth of newly germinated seedlings.** Record results both as length measurements and as accurate, labelled biological drawings to show the effects.	B11.9
9	**Measure the population size of a common species in a habitat.** Use sampling techniques to investigate the effect of a factor on the distribution of this species.	B16.3
10	**Investigate the effect of temperature on the rate of decay of fresh milk.** Measure the pH change of milk to investigate how temperature affects its rate of decay.	B17.4

Chemistry – Core Practicals

Section 3- What are the Chemistry topics you have studied and which have core practicals to learn…

AQA Topics	AQA Chapter	Core Practical	Year Taught	Exam Paper
Atomic Structure	C1 Chapter 1		9	1
The Periodic Table	C1 Chapter 2		9	1
Structure and Bonding	C1 Chapter 3		10	1
Chemical Calculations	C1 Chapter 4	*C4.7 Triple*	9 &10	1
Chemical Changes	C2 Chapter 5	C5.5 C5.6	10	1
Electrolysis	C2 Chapter 6	C6.4	10	1
Energy Changes	C2 Chapter 7	C7.1	10	1
Rates and Equilibrium	C3 Chapter 8	C8.4	10	2
Crude oils and fuels	C3 Chapter 9		11	2
Organic Reactions(Triple only)	*C3 Chapter 10*		11	2
Polymers (Triple only)	*C3 Chapter 11*		11	2
Chemical Analysis	C4 Chapter 12	C12.2 *C12.5 Triple*	10	2
The Earth's Atmosphere	C4 Chapter 13		11	2
The Earth's Resources	C4 Chapter 14	C14.2	11	2
Using our Resources (Triple only)	*C4 Chapter 15*		11	2

Required practicals		Topic
1	**Prepare a salt from an insoluble metal carbonate or oxide.** Prepare with the appropriate apparatus and techniques, a pure, dry sample of a soluble salt from an insoluble carbonate or oxide.	C5.5 C5.6
2	**Use titration to investigate reacting volumes.** Use titration to find out how much of an acid is needed to completely react with an alkali.	C4.7
3	**Investigate the electrolysis of a solution** Investigate the electrolysis of different aqueous solutions using inert electrodes.	C6.4
4	**Investigating temperature changes.** Use appropriate apparatus to investigate the variables that affect energy changes in reactions involving at least one solution.	C7.1
5	**Investigating the effect of concentration on rate of reaction.** Investigate how changes in concentration affect rates of reactions using a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity.	C8.4
6	**Calculate R_f values.** Use paper chromatography to find out the R_f values of the dyes found in different food colourings.	C12.2
7	**Use chemical tests to identify unknown compounds.** Use a range of chemical tests to identify negative and positive ions in ionic compounds.	C12.5
8	**Purify and test water.** Analyse and purify water from different sources, including pH, dissolved solids and distillation.	C14.2

Physics - Core Practicals

Section 4- What are the Physics topics you have studied and which have core practicals to learn…

AQA Topics	AQA Chapter	Core Practical	Year Taught	Exam Paper
Conservation & Dissipation Energy	P1 Chapter 1		10	1
Energy transfer by heating	P1 Chapter 2	P2.4 P2.1	9	1
Energy Resources	P1 Chapter 3		10	1
Electric Circuits	P2 Chapter 4	P4.3/6 P4.4	10	1
Electricity in the Home	P2 Chapter 5		10	1
Molecules and Matter	P2 Chapter 6	P6.1	10	1
Radioactivity	P3 Chapter 7		11	1
Forces	P3 Chapter 8		10	2
Motion	P3 Chapter 9		9	2
Force and Motion	P3 Chapter 10	P10.8 P10.1	10	2
Forces and Pressure (Triple only)	*P3 Chapter 11*		*11*	*2*
Wave Properties	P4 Chapter 12	P12.4	9	2
Electromagnetic Waves	P4 Chapter 13	P13.2	9	2
Light (Triple only)	*P4 Chapter 14*	*P14.2/3 Triple*	*11*	*2*
Electromagnetism	P4 Chapter 15		11	2
Space (Triple only)	*P4 Chapter 16*		*11*	*2*

	Required practicals	Topic
1	**Determining specific heat capacity.** Determine the specific heat capacity of a metal block of known mass by measuring the energy transferred to the block and its temperature rise, and using the equation for specific heat capacity.	P2.4
2	**Investigating thermal insulators.** Use different materials and different thicknesses of the same material to insulate identical beakers of hot water, and measure the change in temperature of the water at regular intervals.	P2.1
3	**Investigating resistance.** Set up circuits and investigate the resistance of a wire, and of resistors in series and parallel.	P4.3 P4.6
4	**Investigating electrical components.** Correctly assemble a circuit and investigate the potential difference-current characteristics of circuit components.	P4.4
5	**Calculating densities.** Measure the mass and volume of objects and liquids and calculate their densities using the density equation.	P6.1
6	**Investigate the relationship between force and extension for a spring.** Hang weights of known mass from a spring and, using the correct apparatus, measure the resulting extension. Use the results to plot a force-extension graph.	P10.8
7	**Investigate the relationship between force and acceleration.** Using a newton-metre, investigate the effect on the acceleration of an object of varying the force on it and of varying its mass.	P10.1
8	**Investigating plane waves in a ripple tank and waves in a solid.** Determine which apparatus are the most suitable for measuring the frequency, speed, and wavelength of waves in a ripple tank, and investigate waves on a stretched string.	P12.4
9	**Investigate the reflection and refraction of light.** Use different substances and surfaces to investigate the refraction and relection of light.	P14.2 P14.3
10	**Investigating infrared radiation.** Determine how the properties of a surface affect the amount of infrared radiation absorbed or radiated by the surface.	P13.2

Word	Definition
Accuracy	Results from experiment are close to the true result.
Precision	Results from experiment are grouped closely together.
Repeatability	An experiment is repeatable if the same investigator repeats the experiment with the same method and equipment and gets the same results.
Reproducibility	An experiment is reproducible if a different investigator does the experiment or uses a different method and equipment and gets the same results.
Validity	The experiment is well designed to answer the hypothesis and only the independent variable affects the dependent variable (all other variables are controlled).
Hypothesis	Scientific prediction which you test using an experiment.
Fair test	Only the independent variable affects the dependent variable (all other variables are controlled).
Calibration	Marking a scale on a measuring instrument. You can check if a thermometer is calibrated correctly by placing it in melting pure ice- it should read 0℃.
Resolution	The smallest change that can be detected by a piece of equipment. E.g. a thermometer has a resolution of 1℃, ruler has a resolution of 1mm.
Anomalies	Any results which are far away from the others (anomalous results are discounted when calculating a mean).
Uncertainty	The interval within which a true value would be expected to lie. E.g. a length of 56 ±2cm could be anywhere between 54 and 58cm.
Random error	Readings differ from the true value in an unpredictable way. Effect of random errors can be reduced by taking more readings, discounting anomalies and calculating a mean.
Systematic error	Readings differ from the true value by the same amount each time. E.g. an ammeter which consistently reads 0.5A high. Need to recalibrate.
Zero error	Readings differ from the true value as the apparatus does not show zero. E.g. scales which read 10g when nothing is on them. A zero error may result in a systematic uncertainty. Need to recalibrate.
Categoric variable	Variable described by a label (e.g type of material).
Continuous variable	Variable described by a number (e.g mass, temperature).
Control variable	Variable which is kept the same during experiment.
Dependent variable	Variable which is measured during experiment.
Independent variable	Variable which is changed during experiment.

Physics Equations to Learn

Section 5- What are the Physics equation I must learn and recall in my exam…

Need to learn	
1.Kinetic Energy	$E_k = ½ \times m \times ve^2$ = ½ x mass x velocity^2
2.Gravitational potential	$E_p = m \times g \times h$ = mass x gravitational field strength x height
3.Power 1	P = E ÷ t = energy ÷ time
4.Power 2	P = W ÷ t = Work ÷ time
5.Efficiency 1	Efficiency = useful power output ÷ total power in
6.Efficiency 2	Efficiency = useful energy output ÷ total energy in
7. Charge	Q = I x t = current x time
8. Voltage	V = I x R = current x resistance
9. Power 3	P = V x I = voltage x current
10. Power 4	$P = I^2 \times R$ = current^2 x resistance
11. Energy	E = Q x V = charge x voltage
12.Density	p = m ÷ vol = mass ÷ volume
13. Weight	W = m x g = mass x gravitational field strength
14. Work done	W = F x s = force x distance
15. Force	F = k x e = spring constant x extension
16. Force 2	F = m x a = mass x acceleration
17. Momentum	P = m x v = mass x velocity
18. Speed 1	v = s ÷ t = distance ÷ time
19. Speed 2	$v = f \times \lambda$ = frequency x wavelength
20. Acceleration	$a = \Delta v \div t$ = change in velocity ÷ time
21.Transformers *(Triple)*	$\frac{Np}{Ns} = \frac{Vp}{Vs}$ Np- Number on primary Vp- voltage on primary Np- Number on secondary Vp- voltage on secondary
22. Pressure *(Triple)*	p = F ÷ A = force ÷ area
23. Moment of a force *(Triple)*	M = F x d = force x distance

Biology and Chemistry Equations to Learn

Section 6- What are the equations in Biology and Chemistry I must learn and recall in my exam…

Biology Equations-

Magnification = Image ÷ Actual

Area of a circle = $A = \pi r^2$

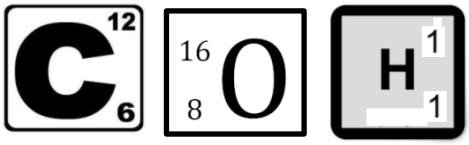
Photosynthesis - $CO_2 + H_2O \xrightarrow{\text{light energy}} C_6H_{12}O_6 + O_2$ - carbon dioxide + water $\xrightarrow{\text{light energy}}$ glucose + oxygen

Aerobic respiration - $C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O$ - glucose + oxygen $\longrightarrow$ carbon dioxide + water

Anaerobic respiration for animals – glucose $\longrightarrow$ lactic acid + energy

Anaerobic respiration for plants – glucose $\longrightarrow$ ethanol + carbon dioxide + energy

Chemistry Equations-



1.A_r = Relative atomic mass
i.e. A_r of carbon = 12

2.M_r = Relative formula mass
i.e. M_r of H_2O = 1+ 1 + 16 = 18

3.Mass = M_r x Mol

4.Percentage yield = $\frac{\text{actual mass of product}}{\text{max theoretical mass of product possible}} \times 100$

5.Percentage mass = $\frac{\text{mass of element}}{\text{Total mass of a compound}} \times 100$

6.Concentration (g/dm^3) = $\frac{\text{amount of solute (g)}}{\text{volume of solution } (dm^3)}$

Maths Skills to Learn

Section 7- What are the other maths skills I must learn and recall in my exam…

Maths Skills-

Standard form question example-
Make sure you can type this into your calculator and get the same answer.

The average power output from one of the wind turbines is 1.6×10^6 W.
The average power output of a nuclear power station is 2.4×10^9 W.
Calculate the number of wind turbines needed to generate power equal to one nuclear power station.

Answer = $2.4 \times 10^9 \div 1.6 \times 10^6$ = 1500 turbines

Significant figures examples-

- 42,500J to 2 s.f = 43,000J
- 0.105 to 2 s.f = 0.11
- 1.002 to s.f = 1.0

Conversions-

Nano	n	1×10^{-9}	0.000 000 001
Micro	µ	1×10^{-6}	0.000 001
Milli	m	1×10^{-3}	0.001
Normal	-	0	
Kilo	k	1×10^{3}	1 000
Mega	M	1×10^{6}	1 000 000
Giga	G	1×10^{9}	1 000 000 000

Good Luck!