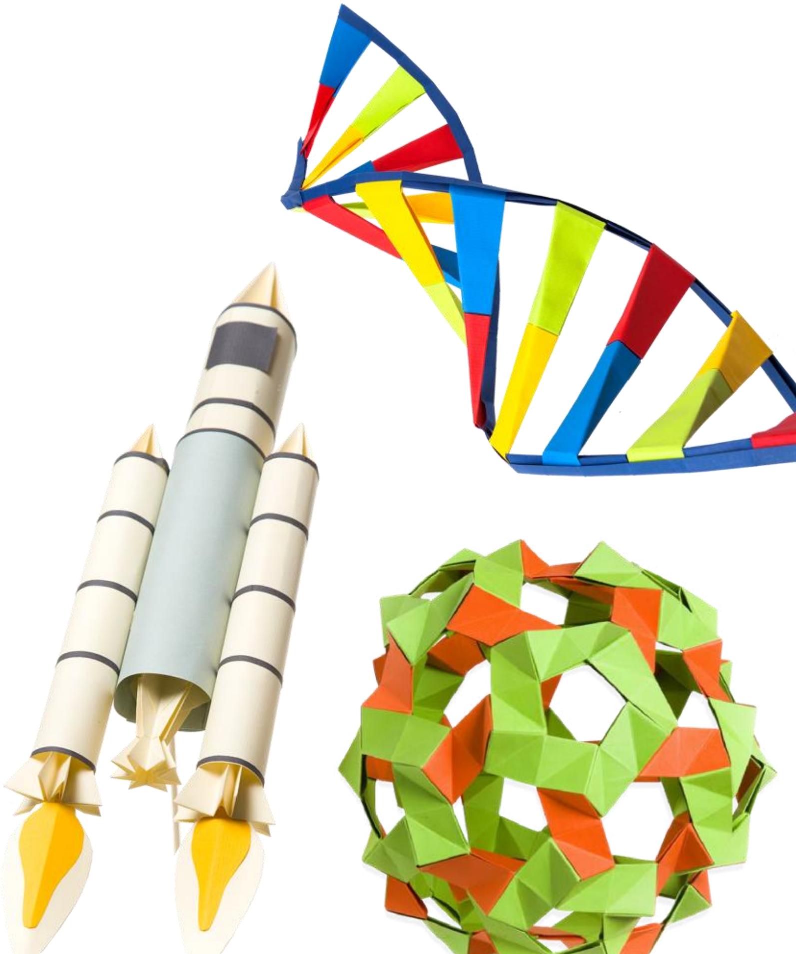
Pearson Edexcel

GCSE
Combined Science

Physics Exam Insights

May/June 2024



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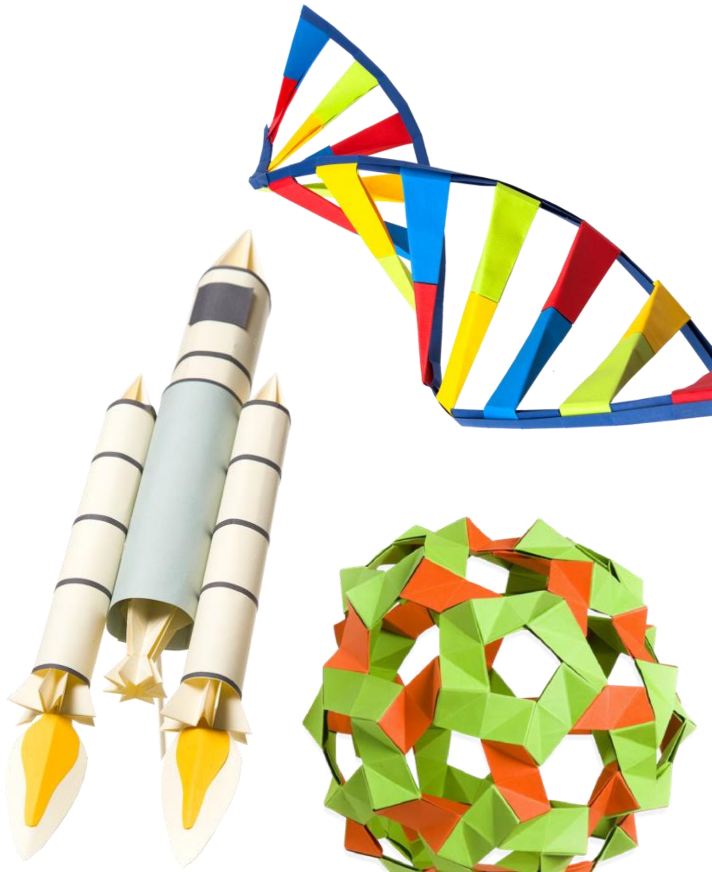
Feedback from the Examiner Reports



Welcome

This training is for teachers of the Pearson Edexcel GCSE Combined Science Physics specification and will provide feedback and insights on the June 2024 exam series. The session will focus on the performance on some of the key questions in the series and provide analysis to support. The session will point out information that may help with your planning for the year ahead.

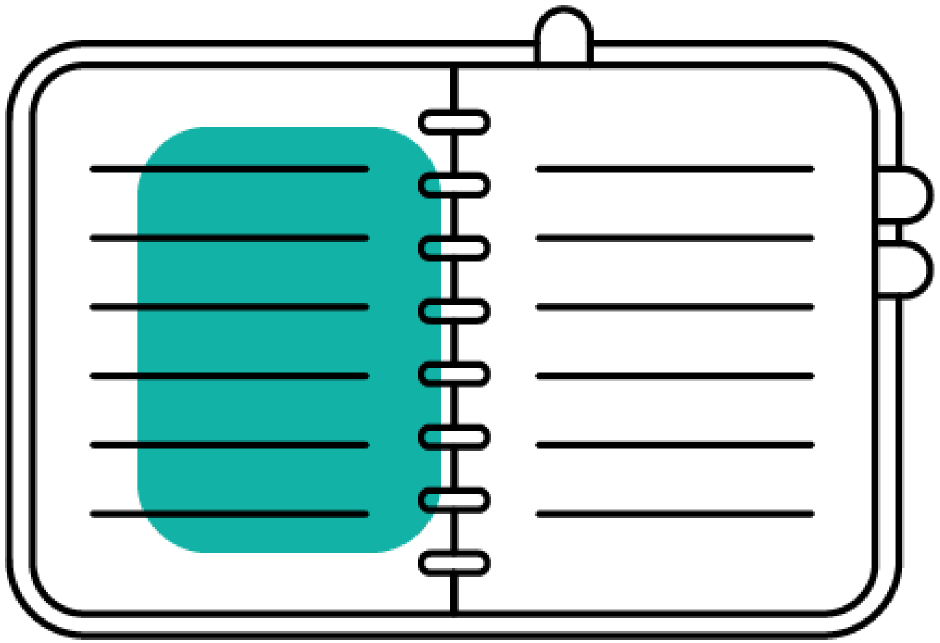
Delegates will:

- receive feedback on the performance of candidates in the June 2024 exam series
- consider the variation of candidates' performance on different questions and explore why performance varies
- discuss the Examiner's Reports

Agenda

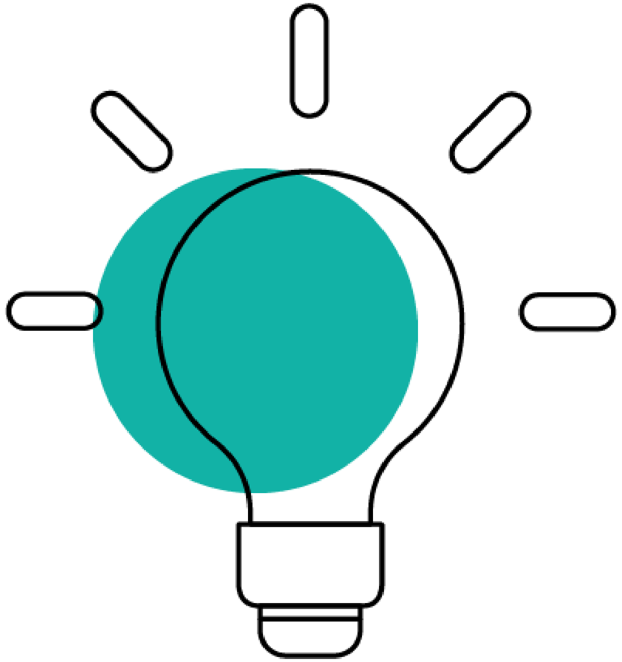
In this session we are going to look at:

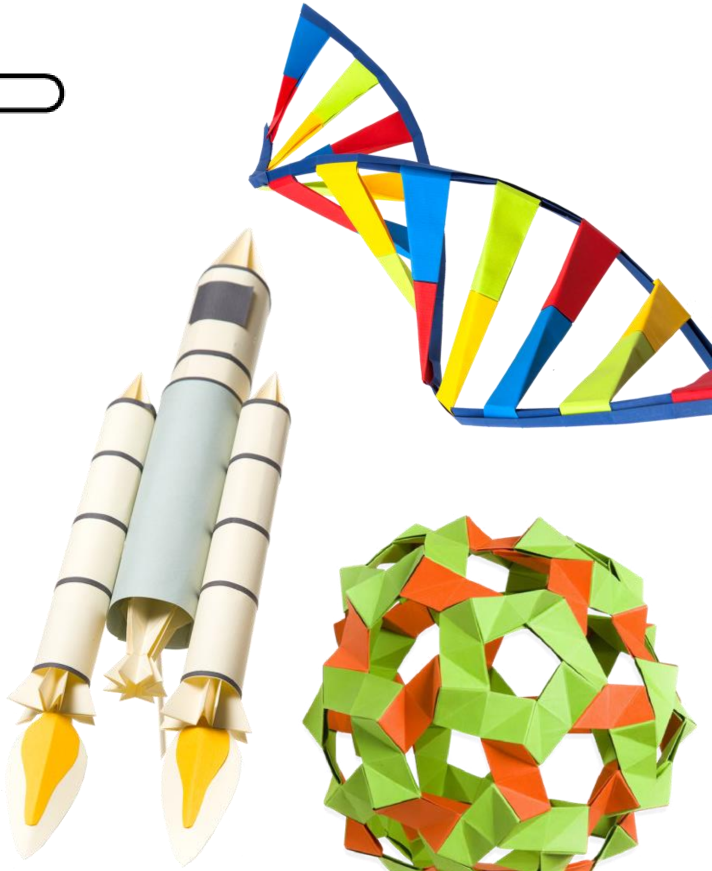
- Key themes
- Examples of questions illustrating points from the key themes



Key themes

1. Calculations
2. Practical work
3. Different contexts
4. General comments





Theme 1: Calculations

Feedback from examiners reporting on both foundation and higher papers was that successful candidates were competent in quantitative work.

However, less successful candidates misread or misunderstood the symbols used in equations and needed to understand more fully how to round values to a suitable number of significant figures.

At foundation level, examiners noted that candidates failed to set out calculations in a logical way that could be easily followed and advised that they write down the equation they are using and show each step in their working. They should also make sure that they recognise SI prefixes such as m, k and n and how to handle these in calculations. Some higher-level candidates struggled to handle powers of 10 in their calculations and needed to know when and how to convert units.

Theme 2: Practical work

Feedback from examiners reporting on both foundation and higher papers was that successful candidates had been engaged with practical work at some stage in their course, although less successful candidates had gaps in their procedural knowledge relating to practical work.

Higher level candidates were advised to make the most of opportunities afforded in science laboratories where they become acquainted with practical work from the specification – both core practicals and suggested practicals.

They were also advised to always ask themselves the question: “What is the purpose of this experiment?” – making sure they are clear in their minds about it. Examiners went on to add that after-the-event evaluations are always useful, especially when reflecting on how the experiment might have been improved.

Theme 3: Different contexts

Feedback from examiners reporting on both foundation and higher papers was that successful candidates were well-acquainted with the content of the specification and were willing to apply physics principles to the novel situations presented to them.

Less successful candidates, however, did not focus sufficiently on what the question was asking and found difficulty in applying their knowledge to new situations.

Foundation level candidates were advised to get used to the idea of applying their knowledge to new situations by attempting questions in previous papers.

Theme 4: General comments

Feedback from examiners reporting on both foundation and higher papers advised candidates to make sure that they had a sound knowledge of the fundamental ideas in all the topics.

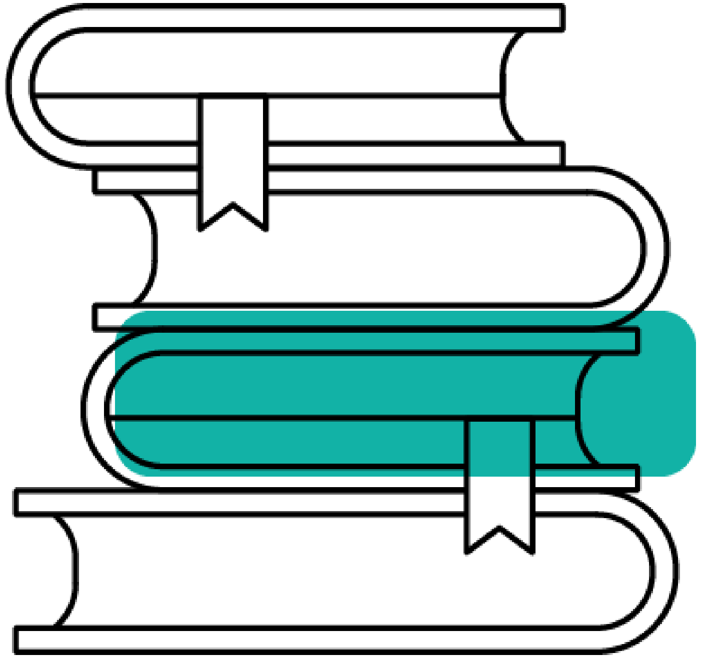
They should use the marks at the side of a question as a guide to the form and content of their answer. In constructing explanations students need to take note of the marks allocated and respond with a corresponding number of points.

Students should, where they can, use diagrams to aid their explanations and use information in diagrams and tables to help with answers. Higher level students were advised to practice writing clear, concise descriptions and explanations.

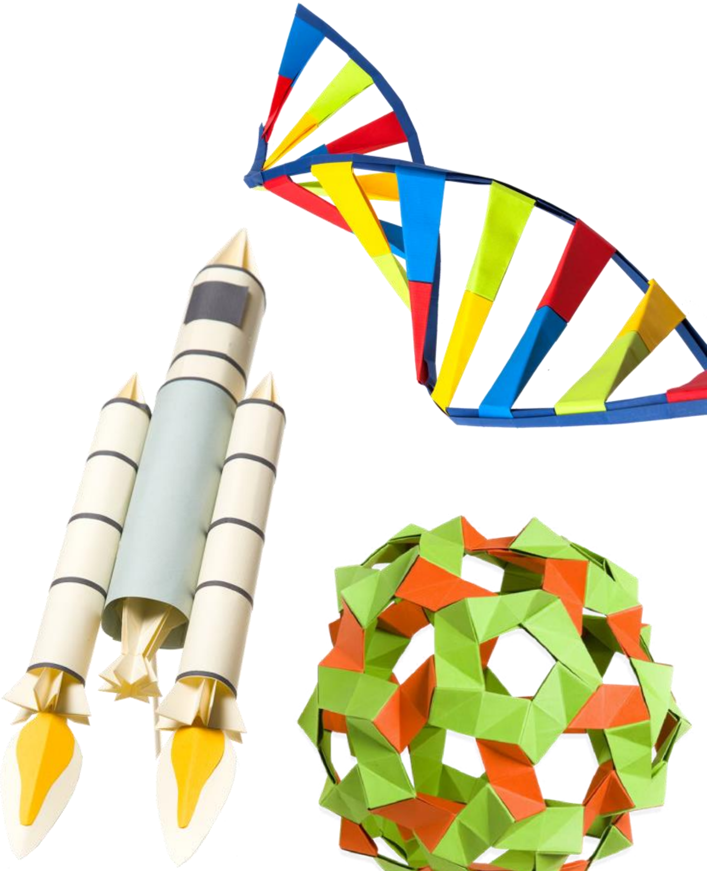
Examples of questions from the papers

Using examples covering:

1. Calculations
2. Practical work
3. Different contexts
4. General comments
5. Extended Open Response



Calculations examples



Calculation –

Paper 1 CS Physics
F tier Q3 (c)

ResultsPlus
Examiner Comments

This shows a good way of working through a question such as this.

First the equation in words followed by the substitution, the rearrangement and the final answer.

3 marks scored

This was a calculation of the frequency of a sound wave from a given equation.

The calculation involved a rearrangement of the equation.

The majority of candidates scored at least 1 mark for this question.

(c) The speed of a sound wave in air is 330 m/s.

The wavelength of this wave is 0.75 m.

Calculate the frequency of this wave.

Use the equation

$$v = f \times \lambda$$

S = 330
Wl = 0.75

(3)

wavespeed = frequency X wavelength
330m/s = ? x 0.75

330 ÷ 0.75 = 440

frequency = 440 Hz

Calculation –

Paper 1 CS Physics
F tier Q6 (b)i

ResultsPlus
Examiner Comments

This shows the calculation of the change in velocity, the substitution and the correct final answer.

2 marks scored

Here candidates had to find the time taken for an acceleration.

The equation was given but the correct change in velocity had to be obtained to gain any marks for the final calculation.

Most of the candidates who scored, scored 2 marks.

Use the equation

$$\text{time taken} = \frac{\text{change in velocity}}{\text{acceleration}}$$

(2)

$10 - 6.2 = 3.8$ $\quad \frac{3.8}{2.5} = 1.52\,s$

time taken = 1.52 s

Calculation –

Paper 1 CS Physics
F tier Q6 (b)i

ResultsPlus
Examiner Comments

This response shows the correct change in velocity and the correct substitution into the equation but the evaluation is not correct.

1 mark scored

Here candidates had to find the time taken for an acceleration.

The equation was given but the correct change in velocity had to be obtained to gain any marks for the final calculation.

Most of the candidates who scored, scored 2 marks.

Use the equation

$$\text{time taken} = \frac{\text{change in velocity}}{\text{acceleration}}$$

(2)

$$\text{time} = \frac{3.8}{2.5} = 1.28$$

time taken = 1.28 s

Calculation –

Paper 1 CS Physics
H tier Q3 (a)ii

In this question, the measurements of wavelength are given in nanometres (nm)

3 Ultraviolet (UV) waves from the Sun travel towards the Earth.

Ultraviolet waves can be grouped by wavelength.

The three groups of wavelengths are UVA, UVB and UVC.

Figure 4 shows, for each group,

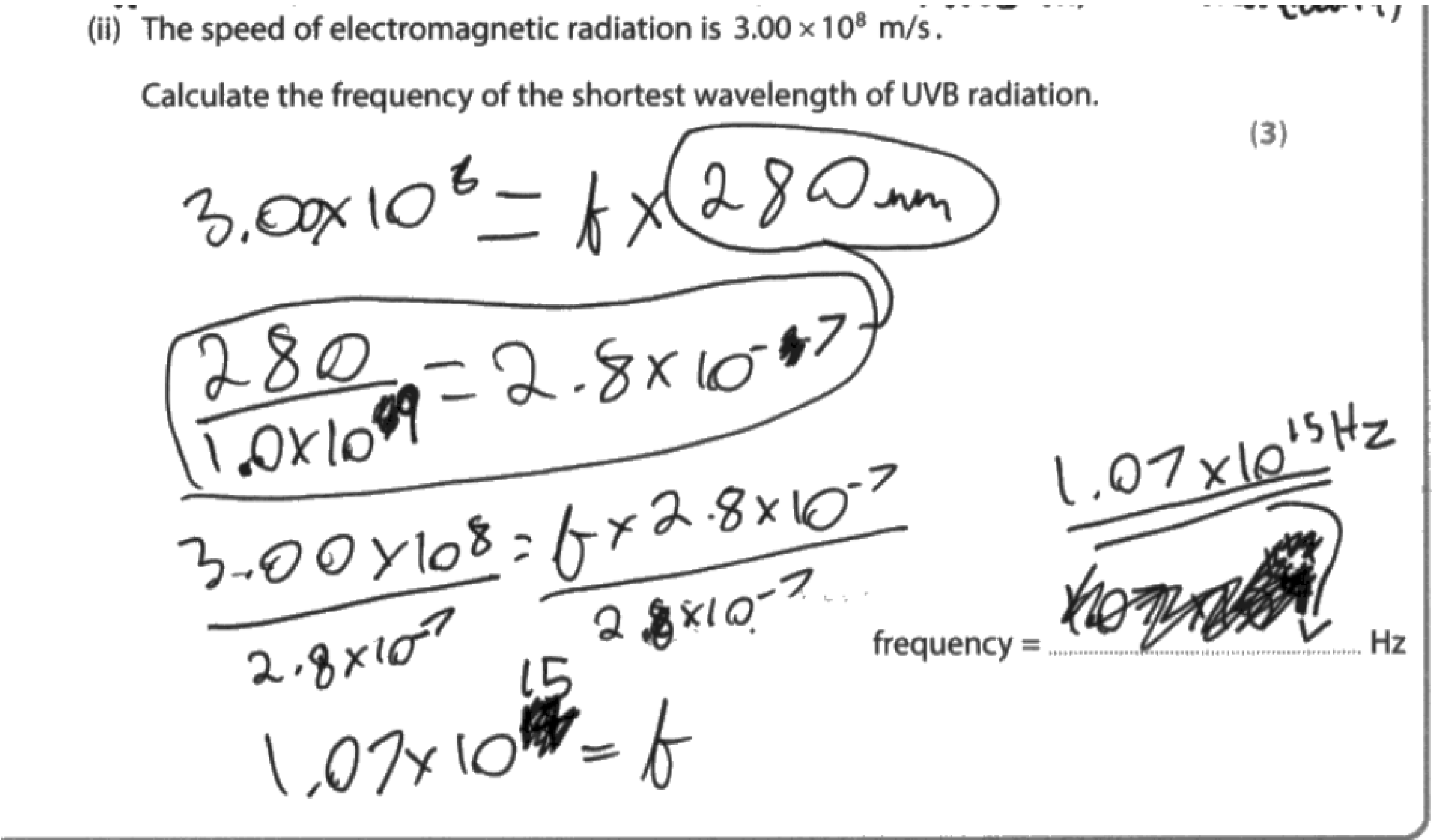
- the wavelength range
- the effect of the Earth's atmosphere on each type of UV wave.

	UVA	**UVB**	**UVC**
wavelength range	400 nm to 315 nm	314 nm to 280 nm	279 nm to 100 nm
% energy absorbed by the Earth's atmosphere	5%	95%	100%

Figure 4

Calculation –

Paper 1 CS Physics
H tier Q3 (a)ii



ResultsPlus
Examiner Comments

Most candidates did not know nm was 10^{-9} m so lost the final mark.

This candidate chose the correct equation to use, substituted and rearranged and understood what nanometres were.

ResultsPlus
Examiner Tip

The whole science specification needs a good recall and understanding of units:

giga(G), mega(M), kilo(k), centi(c), milli(m), micro(μ) and nano(n).

Calculation –
Paper 2 CS Physics
F tier Q4 (b)i

ResultsPlus Examiner Comments

This is an example of correct rounding. There are only two numbers (figures) in the answer of 1500.

This question gave values of energy and time. Candidates were required to use these values in the equation supplied to calculate power.

They were also required to give their answer to 2 significant figures.

The calculation of power was usually done correctly but expressing the answer to 2 significant figures proved difficult for many candidates.

(b) The cooker supplies 130 000 J of energy in a time of 87 s.

(i) Calculate the power supplied by the cooker.

Use the equation

$$P = \frac{E}{t}$$

Give your answer to 2 significant figures.

(3)

Power = ~~energy~~ work done ÷ time taken

130 000 ÷ 87 = 1494.25

to 2 Significant figures: 1500

power = 1500 W

Calculation –

Paper 2 CS Physics
F tier Q4 (b)i

ResultsPlus Examiner Comments

The calculation of power was correct. However, the candidate has expressed the result to 2 decimal places rather than 2 significant figures. There are many more than 2 numbers (figures) in the final answer of 1494.25

ResultsPlus Examiner Tip

Make sure that you know how to correctly round a value shown on a calculator.

This question gave values of energy and time. Candidates were required to use these values in the equation supplied to calculate power.

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(i) Calculate the power supplied by the cooker.

Use the equation

$$P = \frac{E}{t}$$

Give your answer to 2 significant figures.

(3)

$\frac{130000}{87} = 1494.252874$

2sf = 1494.25

power = 1494.25 W

Calculation –

Paper 2 CS Physics
H tier Q2 (c)

ResultsPlus Examiner Comments

One mark is scored because the grams are not converted to kilograms.

ResultsPlus Examiner Tip

Remember that the standard unit to use for mass is kilograms.

This question included the use of standard form and a conversion from grams to kilograms. About a third of candidates gained both marks and as the equation was given and no rearrangement required it was usually a power of ten error that lost the second mark for evaluation.

This example shows the most frequent error.

$60.0 \times 2.26 \times 10^6 =$

135600000

amount of thermal energy = 135600000 J

Calculation –

Paper 2 CS Physics
H tier Q2 (c)

ResultsPlus
Examiner Comments

The first mark is scored for correct substitution. This example also shows that grams have been converted to kilograms correctly. The second mark is for the correct evaluation.

ResultsPlus
Examiner Tip

Practice using standard form on your calculator.

$Q = m \times L$ 60g = 0.06kg

(2)

$Q = 0.06 \times 2.26 \times 10^6$

$= 135600J$

amount of thermal energy = 135600 J

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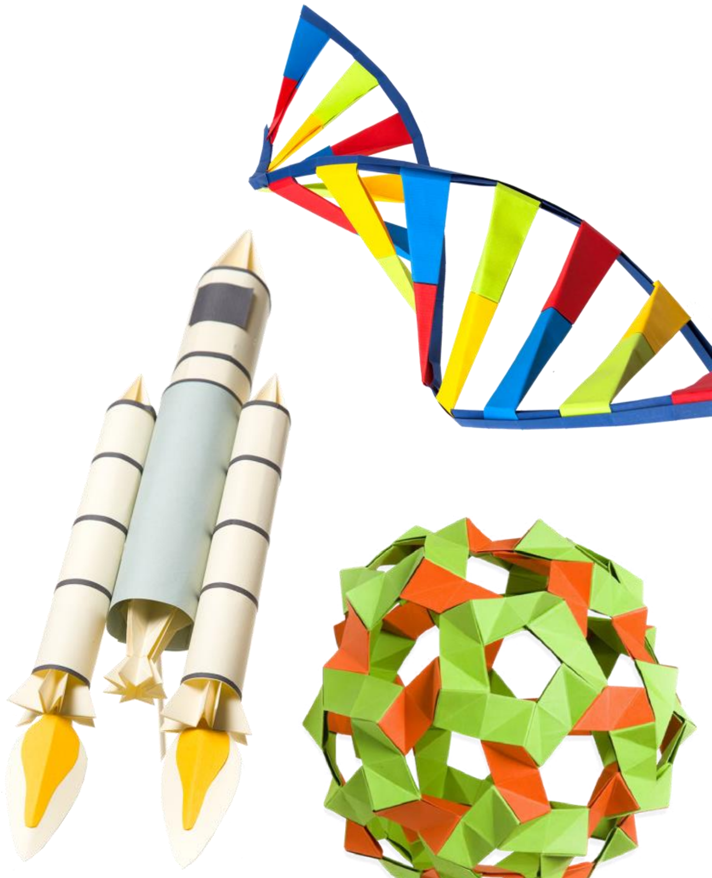
Practicals examples



Practicals –

Paper 1 CS Physics
H tier Q5 (c)

ResultsPlus
Examiner Comments

This example shows how relatively straightforward it was to obtain the full three marks.

Many candidates talked of using a GM tube, but not much else.

There were six possibilities given in the marks scheme for scoring those 3 marks.

(c) A teacher determines the background radiation count rate in a laboratory.

Explain how to determine a value for the background radiation count rate.

get a a geiger counter and hold it up. measure how many beeps you hear a ~~second~~ minute. Calculate an average.

Practicals –

Paper 1 CS Physics
H tier Q5 (c)

ResultsPlus
Examiner Comments

This gained 3 marks for

- GM counter mention
- repeat readings
- take an average

(c) A teacher determines the background radiation count rate in a laboratory.

Explain how to determine a value for the background radiation count rate.

(3)

- Gm counter will beep when radiation is present
- ensure repeat experiment to find an average
- count the number of beeps the Gm counter makes
- measure distance of source from counter to find the value for background radiation count rate

Practicals –

Paper 1 CS Physics
H tier Q5 (d)iii

ResultsPlus
Examiner Comments

This question (part of the same question above, about a practical demonstration to find the background radiation count) showed low achievement.

Candidates appeared not to be able to apply their procedural knowledge to this item.

(iii) Name a quantity that must be kept constant during the investigation.

(1)

The distance of the beta radiation source from the geiger- muller counter

ResultsPlus
Examiner Comments

This was the expected response, earning the mark.

(iii) Name a quantity that must be kept constant during the investigation.

(1)

the distance between the source and the aluminium

ResultsPlus
Examiner Comments

This is also a possible constant.

6 possible ways of getting the mark are listed in the mark scheme.

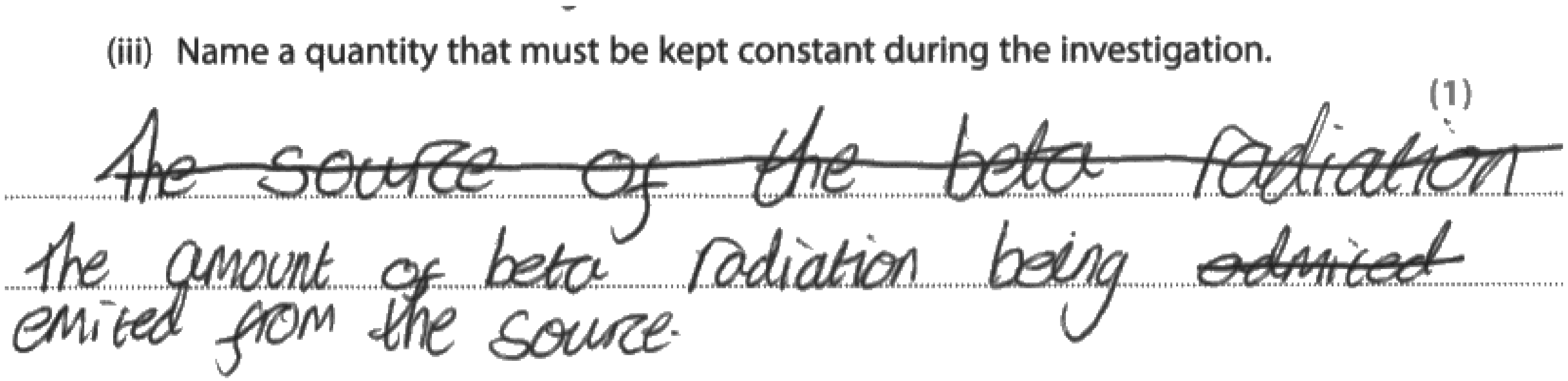
Practicals –

Paper 1 CS Physics
H tier Q5 (d)iii

ResultsPlus
Examiner Comments

Unfortunately, this was an all too frequent response.

It is not a control variable.


(iii) Name a quantity that must be kept constant during the investigation.
(1)

~~The source of the beta radiation~~ the amount of beta radiation being ~~admited~~ emited from the source.

Practicals –

Paper 2 CS Physics
F tier Q5 (b)ii

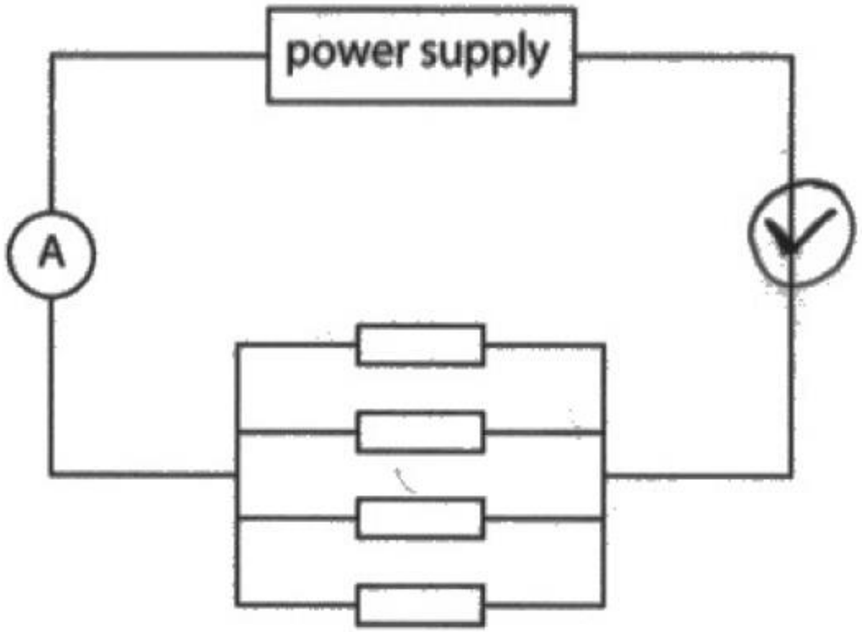
ResultsPlus
Examiner Comments

This candidate's answer is incorrect – a voltmeter is not connected in series.

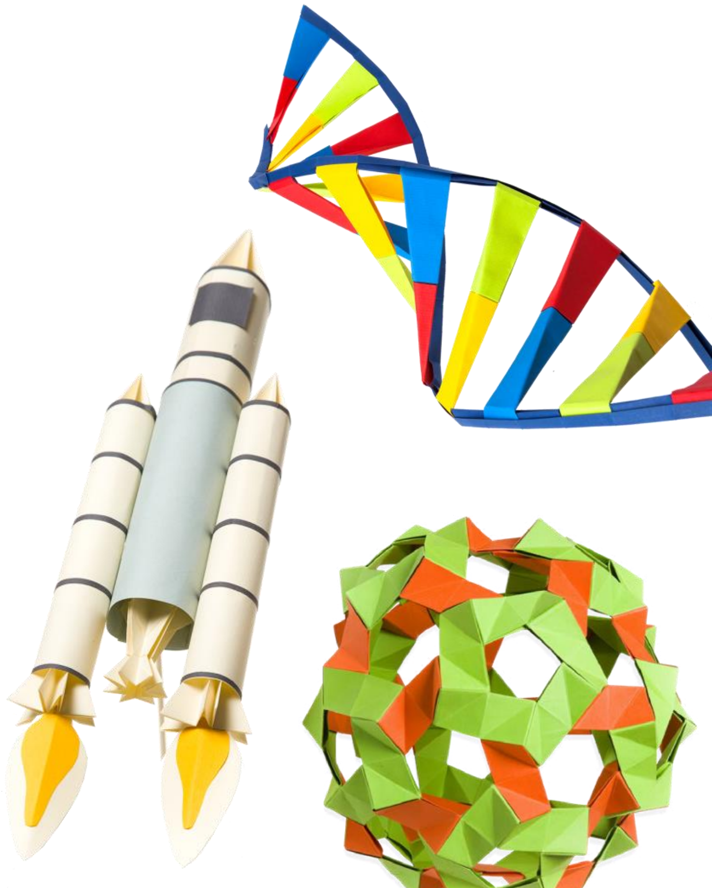
0 marks

Candidates were asked to add to a circuit diagram by drawing a voltmeter connected to measure the voltage (p.d.) across a resistor. As in the previous question, this is commonly tested in this paper, and it is disappointing that so few candidates were able to do this correctly.

Most commonly the voltmeter was drawn in series rather than across the resistor(s).



Different Contexts examples



Different contexts –

Paper 2 CS Physics
F tier Q2 (c)

(ii) Describe how the student could use the paper clips to find out which of the two permanent magnets is the stronger magnet.

(2)

Put the clips on a table and hold the magnets in each hand then hold the magnets near the clips which ever magnet attracts the most clips is the strongest.

ResultsPlus
Examiner Comments

A clear description of the method together with the expected result. This scored both marks.

Different contexts –

Paper 2 CS Physics
F tier Q2 (c)

ResultsPlus
Examiner Comments

Although the method was described for 1 mark, it does not include the expected result. “find out how many…” is still part of the method.

A second mark would be scored by saying which magnet would have the most paper clips hanging.

(ii) Describe how the student could use the paper clips to find out which of the two permanent magnets is the stronger magnet.

(2)

Hold the magnet in the air and find out how ~~mau~~ many paperclips can hang together before detatching from eachother.

Different contexts –

Paper 2 CS Physics
F tier Q2 (c)

An alternative method was to compare the distances at which each magnet would attract a paper clip.

(ii) **Describe how the student could use the paper clips to find out which of the two permanent magnets is the stronger magnet.**

(2)

The student could place one paperclip further away and slowly bring ~~it close~~ the magnet closer and measure how far it takes for the magnet to join on to the paperclip. The further the paper clip the stronger the magnet.

Screenshot of candidate work

ResultsPlus
Examiner Comments

A clear description of the method together with the expected result ("the further the paper clip the stronger the magnet")

2 marks

Different contexts –

Paper 2 CS Physics
H tier Q4 (b)i

(b) Figure 9 shows an electric motor lifting a set of masses.

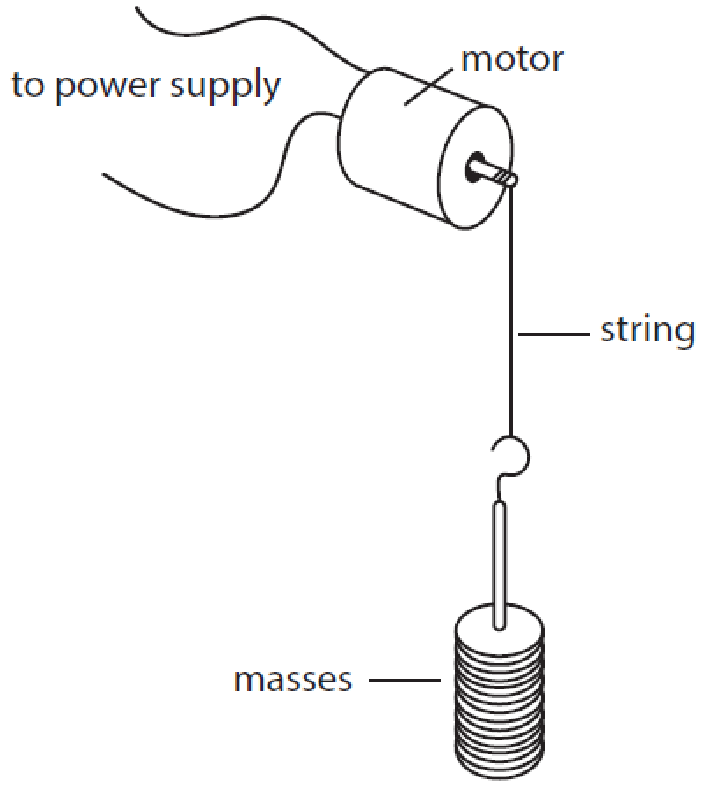


Figure 9

(i) Describe an experiment, using the apparatus in Figure 9, to determine the gravitational potential energy gained by the masses as they are lifted.

Your description should include any measuring devices to be used.

You may add to the diagram in Figure 9 if it helps your answer.

(4)

Different contexts –

Paper 2 CS Physics
H tier Q4 (b)i

The response gives a complete description of the experiment which scores full marks.

Gravitational potential energy = mass x gravitational field strength x change in vertical height.

- Measure change in vertical height using a meter rule. Measure the ~~whole~~ distance before the masses are lifted and distance where the masses are after lifted. Then do distance before lifted - distance after lifted to find change.
- Measure mass by weighing the total number of masses lifted on a balance.
- The gravitational field strength we know is 9.8N on earth

Substitute these 3 numbers into the equation above to find gravitational potential energy. This is measured in Joules.

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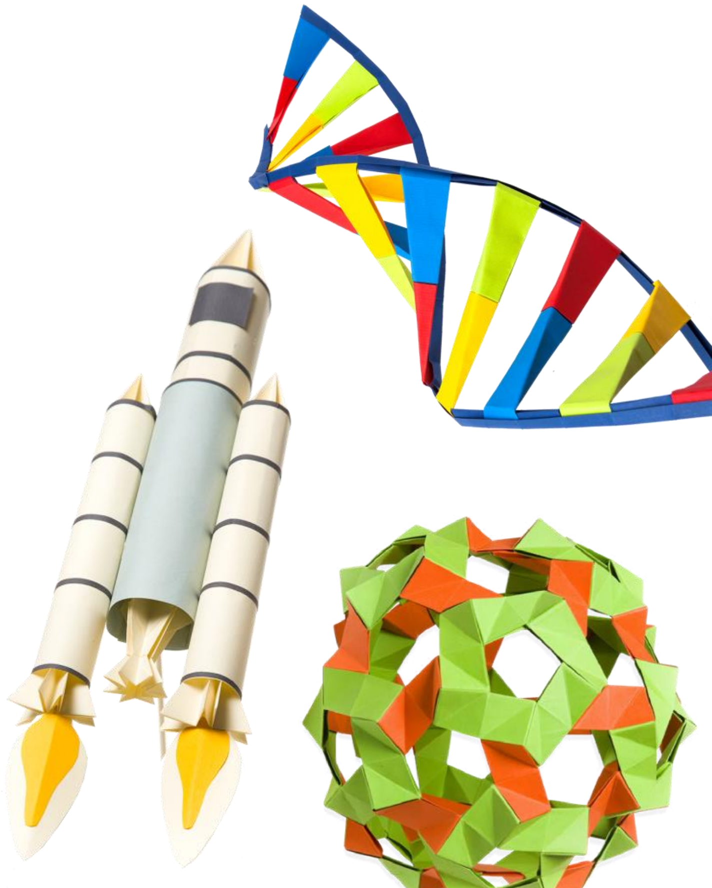
General comments examples



General comments –

Paper 1 CS Physics
H tier Q3 (b)i

(b) UV radiation of wavelength 365 nm is used to detect forged banknotes.

In a genuine banknote there are marks that **cannot** be seen using visible light.
These marks **can** be seen using UV radiation.

Explain why the marks can be seen when the UV radiation shines on the banknote.

Your answer should refer to the energy of electrons in atoms.

You may draw a diagram to help with your answer.

(4)

General comments –

Paper 1 CS Physics
H tier Q3 (b)

For ease of reference here are the mark scheme points:

1) UV/energy absorbed by electrons (1)

2) electrons change orbit/energy level/shell (1)

3) electrons in an 'excited' state (1)

4) electrons emit energy/ move to lower energy level/fall down/de-excite (1)

5) (energy) emitted as (visible) light/at a different frequency/wavelength (1)

6) (process is called) fluorescence/(light emitted is) fluorescent (1).

Please note the mark scheme points must be hit explicitly. Examiners cannot do the work for candidates by inferring or seeing these as implicit. Clearly judgement is required as candidates' language varies.

General comments –

Paper 1 CS Physics
H tier Q3 (b)

ResultsPlus Examiner Comments

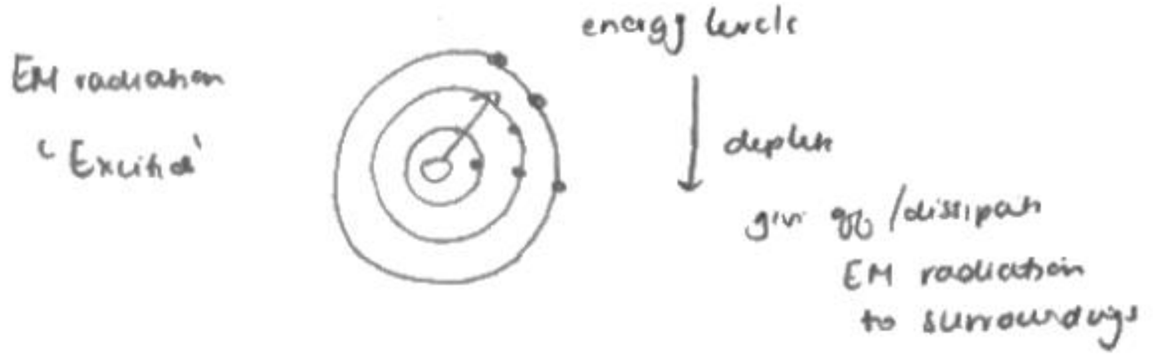
Mark points 2, 3, 4 and 6 are most clearly met, with points 2, 3 and 4 being discernible in the diagram alone.

ResultsPlus Examiner Tip

Wise use of diagrams can really help your answers.

You may draw a diagram to help with your answer.

(4)



Ultraviolet was used for fluorescent lamps. However, they later placed traces that could be identified with Ultraviolet Radiation. When electrons take in Electromagnetic Radiation, they 'jump' to the next Shell. They are said to be 'excited.' However, when the energy levels are not enough to stay in that electron shell, they 'drop' down. Electromagnetic energy dissipates to the surroundings.

UV radiation detects traces and can identify forged notes and cash.

General comments –

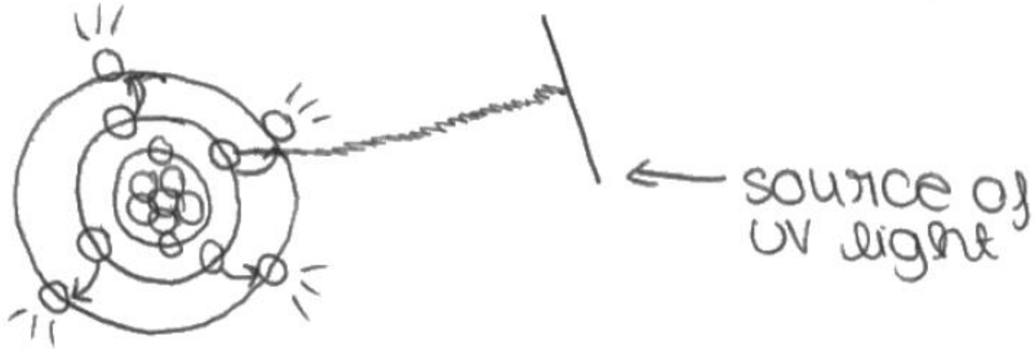
Paper 1 CS Physics
H tier Q3 (b)

ResultsPlus Examiner Comments

This scores mark points 2 and 6

You may draw a diagram to help with your answer.

(4)



› The electrons in the atoms gain enough energy from the UV rays to 'jump up' onto the outer shells of the atom.

› By exerting this energy, the atom gives off this energy as visible light, activated by the UV radiation

› This happens continuously to the electrons whilst under the UV light.

General comments

Paper 1 CS Physics
H tier Q5 (d)i

ResultsPlus
Examiner Comments

Full marks achieved with the aluminium sheets between the source and the GM tube.

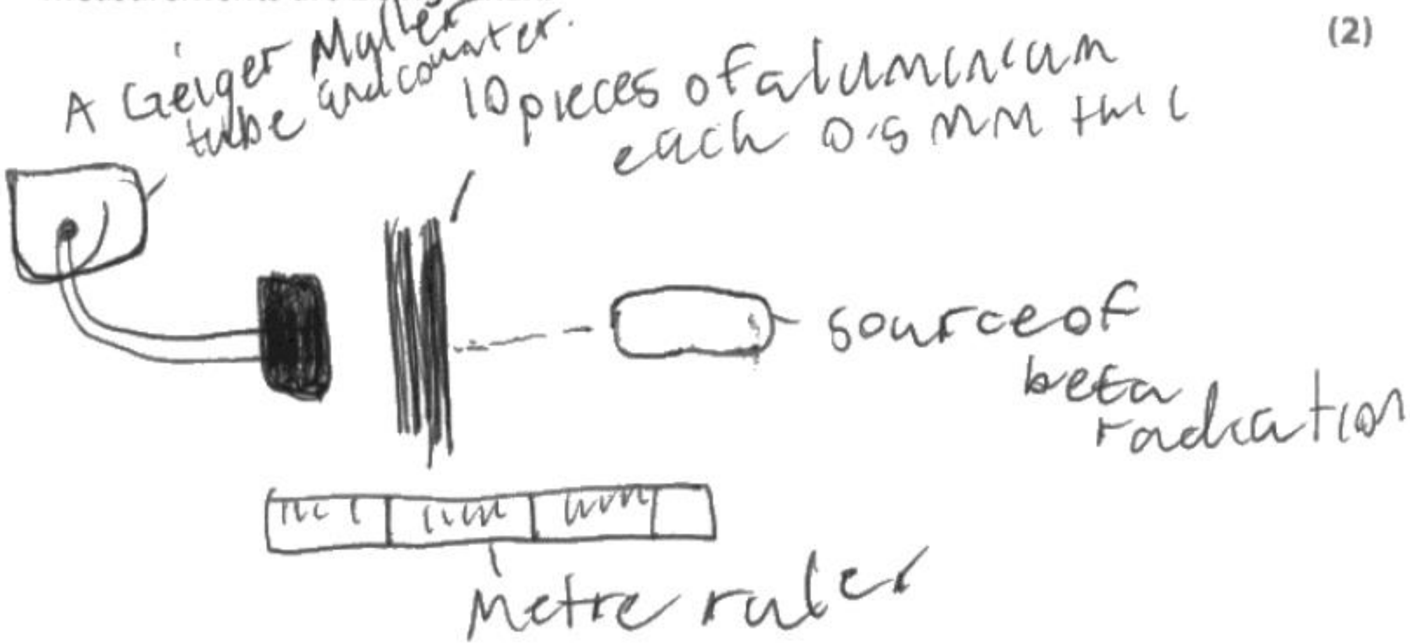
(d) The teacher now investigates the absorption of beta radiation by different thicknesses of aluminium.

The apparatus available is

- a source of beta radiation
- a Geiger–Müller (G-M) tube and counter
- 10 pieces of aluminium, each 0.5 mm thick
- a metre rule.

(i) Sketch a labelled diagram showing the positions of the apparatus when the measurements are being taken.

(2)



General comments

Paper 1 CS Physics
H tier Q5 (d)i

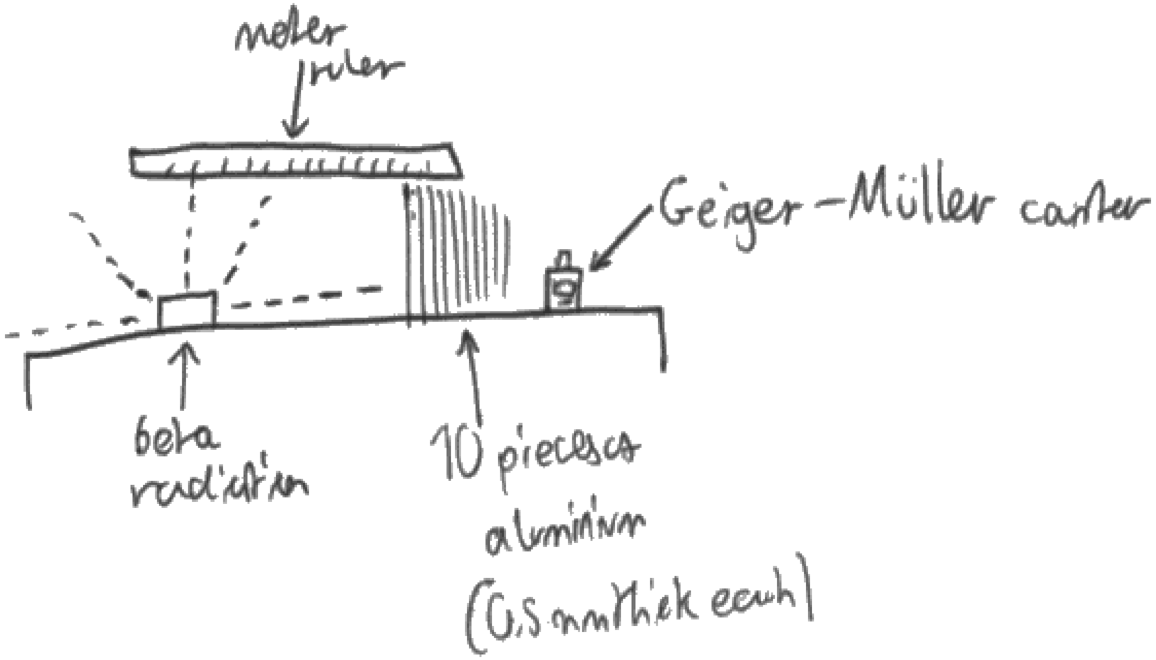
Another well drawn sequence with the correct idea.

The apparatus available is

- a source of beta radiation
- a Geiger–Müller (G-M) tube and counter
- 10 pieces of aluminium, each 0.5 mm thick
- a metre rule.

(i) Sketch a labelled diagram showing the positions of the apparatus when the measurements are being taken.

(2)



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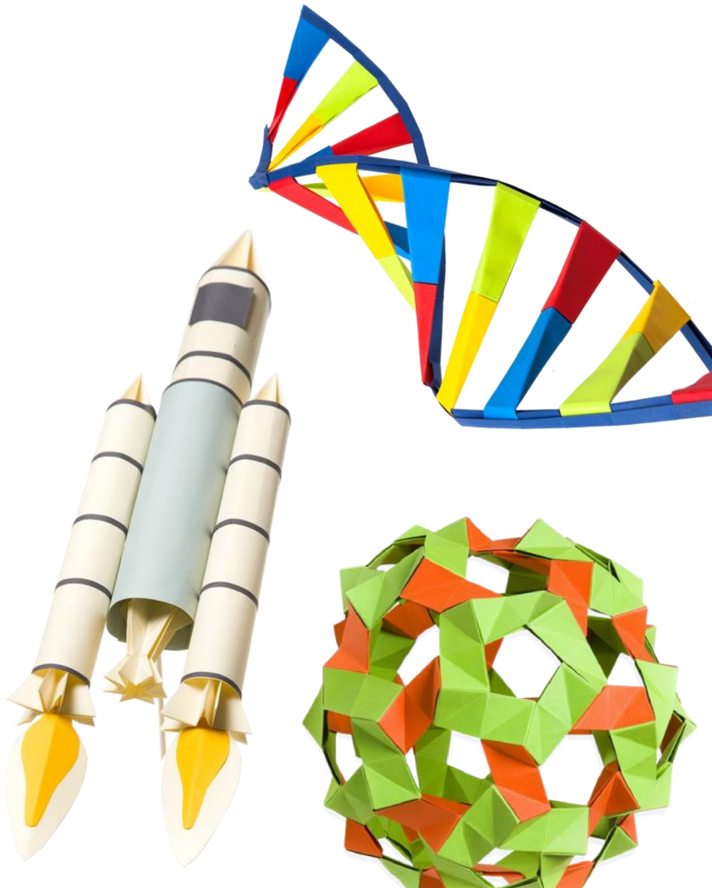
Extended Open Response (EOR) examples



Extended Open Response –

Paper 2 CS Physics
F tier Q6 (d)

This question asked candidates to describe the changes of state shown by a temperature-time graph as ice is heated from –20°C to 100°C. This is a core practical, and candidates were expected to be able to clearly describe where, on the graph, the ice was melting and where the water was turning to a gas.

Although the change from liquid to gas at 100°C was often correctly described, there was often confusion about where the ice was melting and where the temperature of liquid water was rising. In particular, melting was often thought to occur either immediately that the temperature first reached 0°C or over the time when the temperature was rising from 0°C to 100°C.

Extended Open Response –

Paper 2 CS Physics
F tier Q6 (d)

ResultsPlus
Examiner Comments

The labels on the graph give a good indication that the candidate understands the changes of state and when they are happening

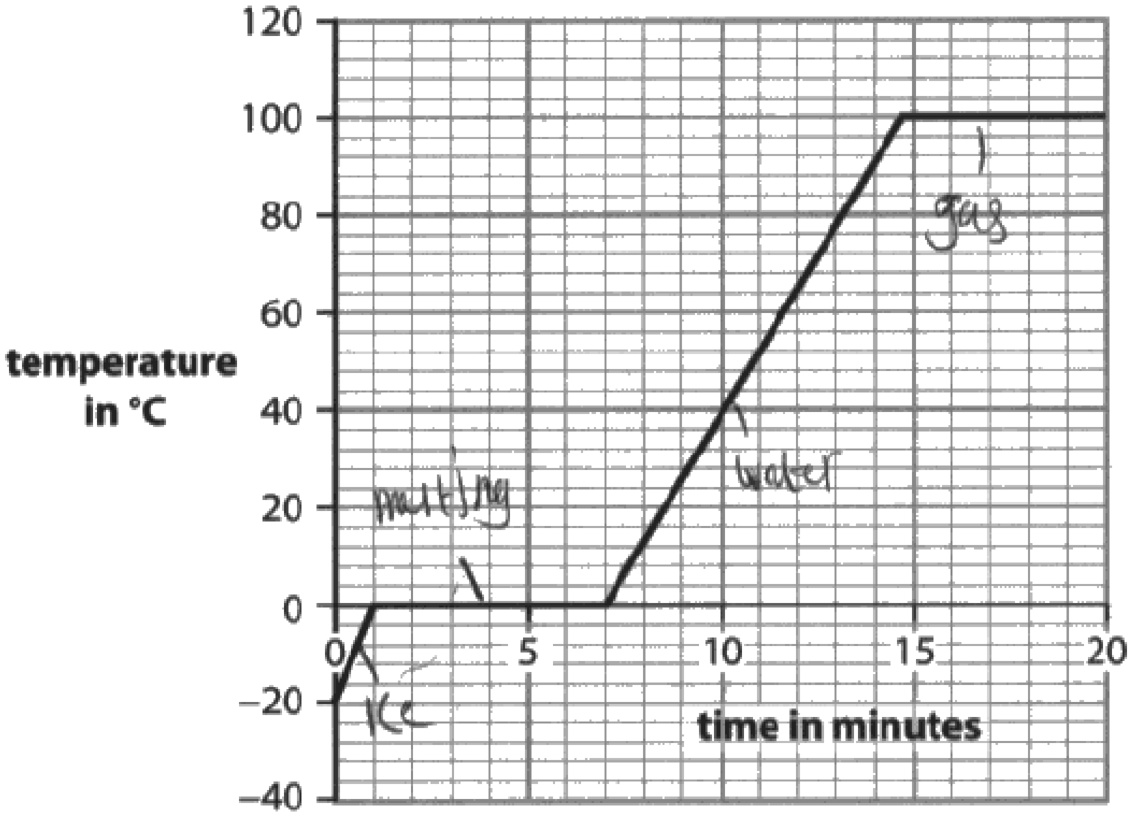


Figure 14

Using information from the graph, describe the changes that take place in the 20 minutes shown on the graph.

Your answer should refer to

- data from the graph
- the state (solid, liquid or gas) of the contents of the beaker.

Extended Open Response –

Paper 2 CS Physics
F tier Q6 (d)

ResultsPlus
Examiner Comments

The writing confirms this although it becomes a bit confused about when the water evaporates by stating that this occurs between 7 and15 minutes.

An answer does not need to be totally free of errors in order to demonstrate accurate and relevant physics understanding.

Level 3 response scoring 6 marks.

At -20°C the state of the ice is solid, at 1-7 mins at 0°C the ice start to melt into water liquid form. Then at 7-15 minutes the water slowly starts to to evaporate from liquid to gas as we move from 0°C to 100°C, however at 100°C temperature is no longer the limiting factor so at 15-20 minutes the ice just stays in its gas form as there is no form beyond this that it can take.

Extended Open Response –

Paper 2 CS Physics
F tier Q6 (d)

ResultsPlus
Examiner Comments

The first statement about being a solid at the start is correct although the temperature is stated to be 20°C and not -20°C.

The, incorrect, idea that melting starts at 7 mins was often see. Many candidates did not seem to realise that the melting took place between 1 and 7 mins while the temperature remained at 0°C.

- At 0 Minutes tempature of the Substance is 20° which is also a Solid
- A 7 Minut es the Solid starts to melt
- It gradually goes up increasing the Tempature
- The water at 15 Minutes reaches it's Boiling point and this the ~~wto~~ where it starts evaporating into ~~gases~~ gases

Extended Open Response –

Paper 2 CS Physics
H tier Q6 (d)

Describe an investigation to determine the value for the specific heat capacity of water.

Your answer should include details of

- the apparatus needed
- the experimental procedure
- how the value may be calculated from the measurements taken.

You may draw a diagram to help your answer.

Extended Open Response –

Paper 2 CS Physics
H tier Q6

ResultsPlus Examiner Comments

Level 1 – 2 marks.

The first line gives the equation to be used. There is no labelled diagram but lines 2 and 3 give the apparatus as thermometer, beaker and mass balance.

The remaining lines do not contain any credit worthy material

ResultsPlus Examiner Tip

Always draw a diagram. It will help you focus on an accurate description.

- Change in thermal energy = mass × specific heat capacity × change in temperature
- Apparatus needed: thermometer, beaker of water, mass balance,
- Independant variable = temperature, mass
- Dependant variable = specific heat capacity
- Control variable = volume of water

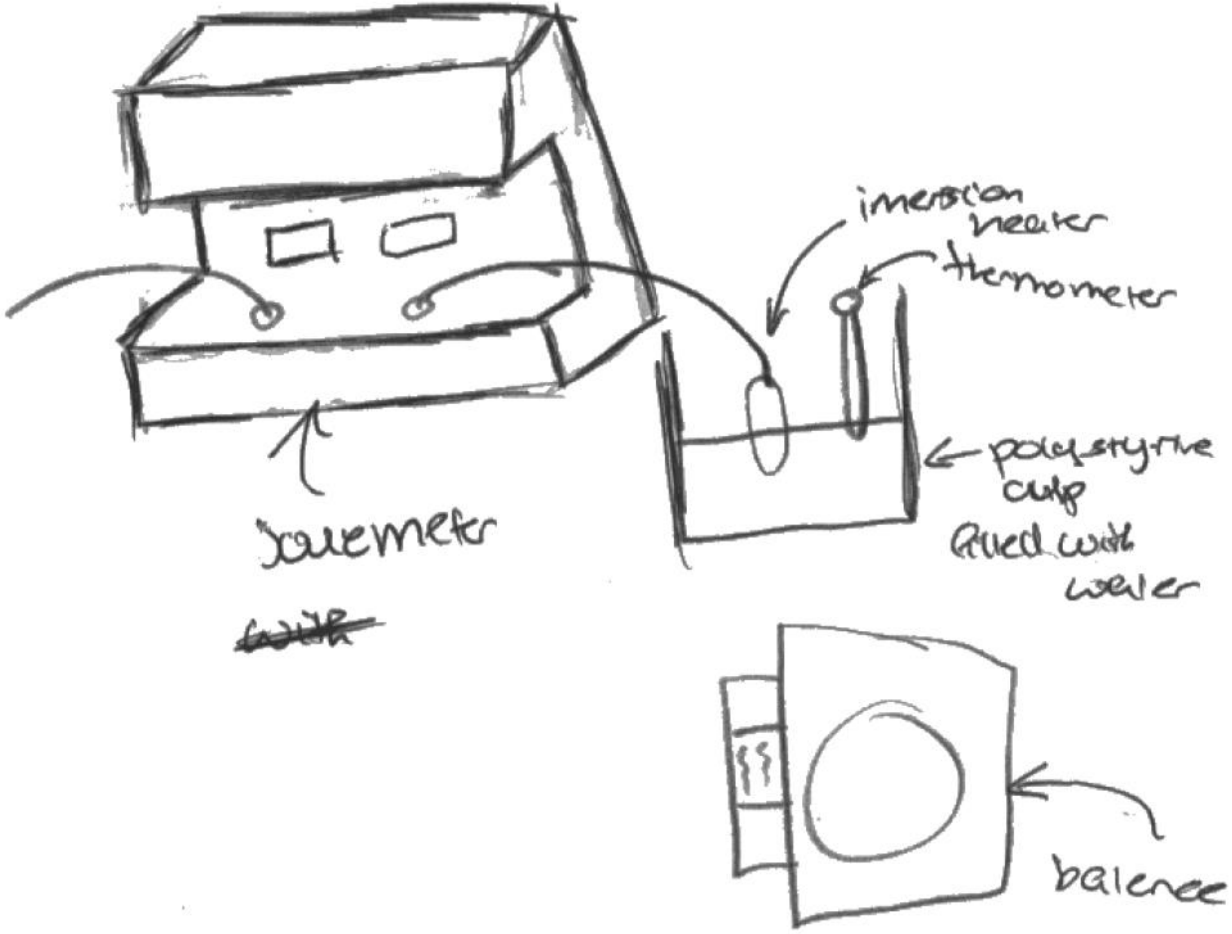
Extended Open Response –

Paper 2 CS Physics
H tier Q6

ResultsPlus Examiner Comments

Level 3 – 6 marks

The labelled diagram shows all the apparatus needed for the experiment.



Extended Open Response –

Paper 2 CS Physics
H tier Q6

ResultsPlus
Examiner Comments

The text starts off by giving the equation text.

The mass of the water is measured using a balance.

The initial temperature is measured using a thermometer and a joulemeter measures the thermal energy.

There is a precaution to add a lid and insulation.

After heating the new temperature and thermal readings are taken.

The values are then used in the equation to calculate a value for the specific heat capacity.

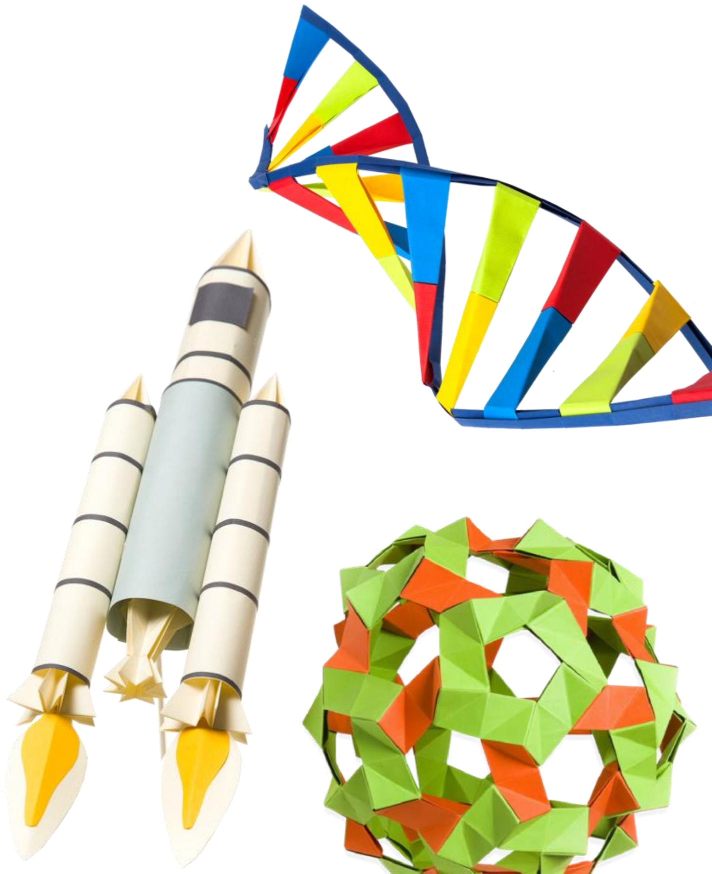
Specific heat capacity = $\frac{\text{Change in thermal energy}}{\text{Mass} \times \text{Change in temperature}}$

you ~~need to~~ mesure the mass by ~~measuring the~~ Putting beaker on ~~balene~~ balence then zero it. then add your water and take the mesurement of the mass. mesure the starting tempeedue using a thermomeers and the change in thermal energy using a joulemeter. caver water with a lid and make sure cup is insulated to reduce ~~of~~ heat loss to surroundings.

after heating take new temperature ~~of~~ using thermometer and the new thermal energy ~~int~~ using a joule meter. plug values into equation as seen at the top to calculate specific heat capacity. you can repeat this 3 times to find an average specific ~~latant~~ heat capacity

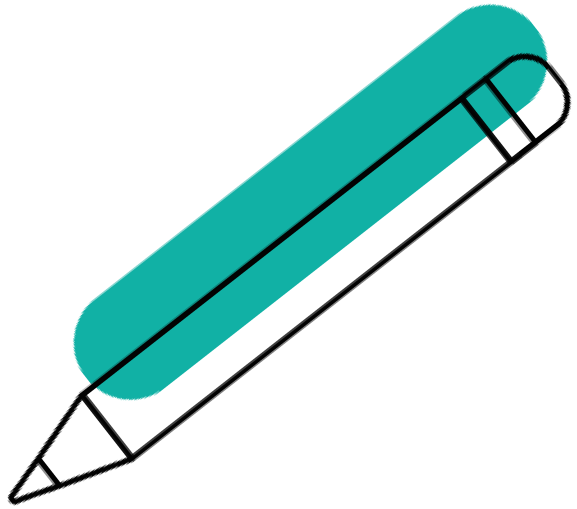
(Total for Question 6 = 12 marks)

Teaching & Learning ideas and discussion



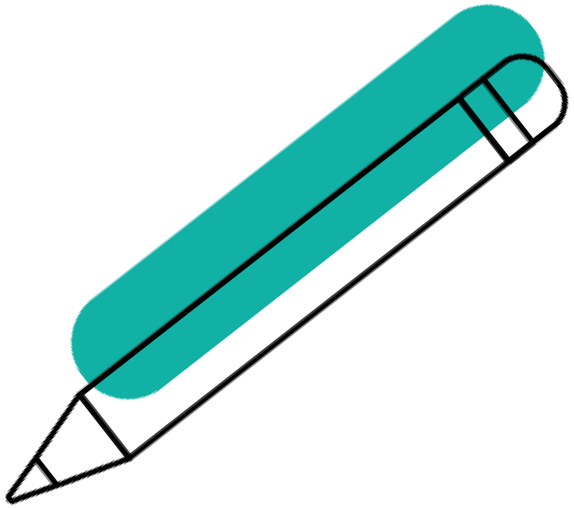
Calculations

- ❑ Rounding values to a suitable number of significant figures
- ❑ Set out calculations in a logical way – show each step in the working
- ❑ Know and recognise SI prefixes such as m, k and n and know how to handle these in calculations
- ❑ Know when and how to convert units



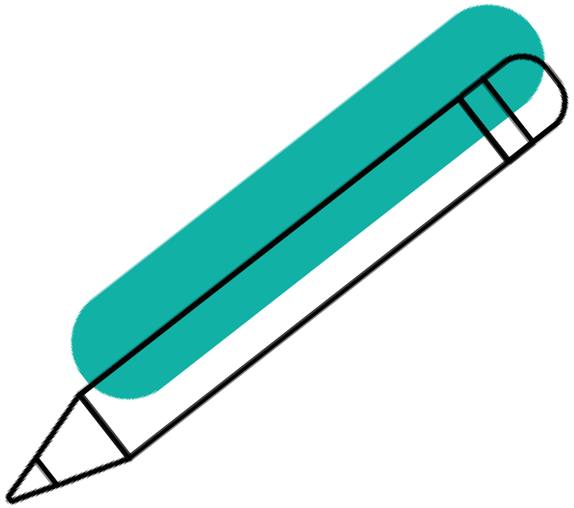
Practical work

- Address gaps in ‘procedural knowledge’ relating to practical work
- Always ask the question ‘What is the purpose of this experiment?’
- Evaluate experiments, reflect on what might be improved



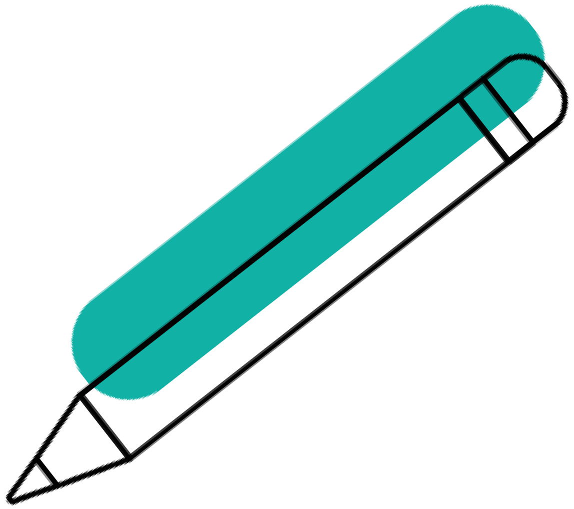
Different contexts

- ❑ Get used to the idea of applying knowledge to new situations… (by attempting questions in previous papers)



General comments

- ❑ Take note of the marks allocated and respond with a corresponding number of points
- ❑ Where you can, use diagrams to aid explanations



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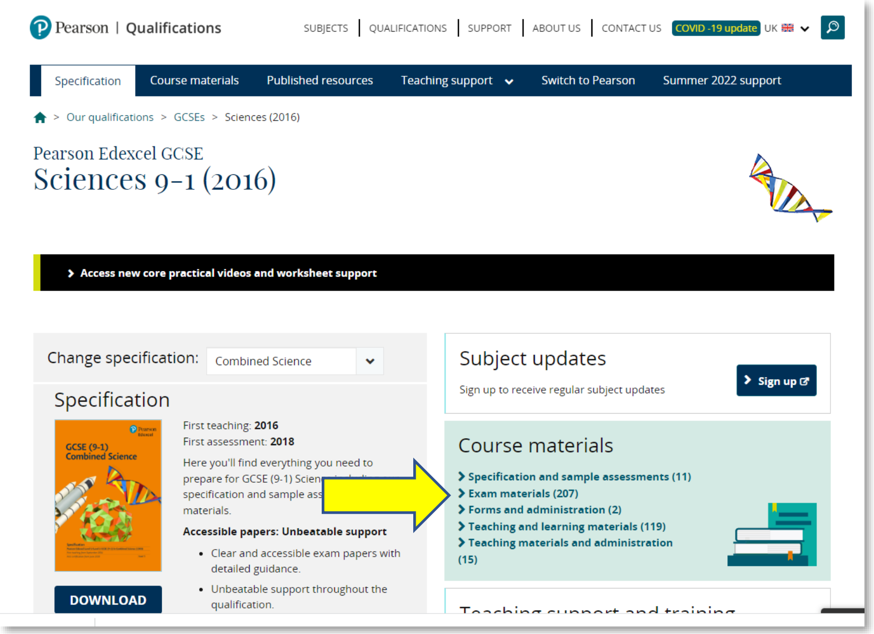
You can find the full Examiner's Reports for the 2024 series by following this link:

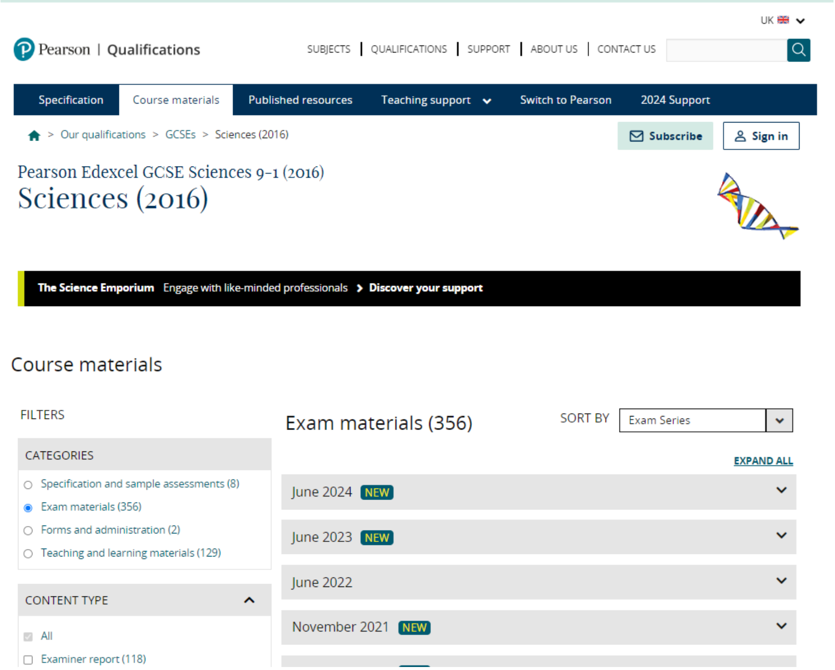
https://qualifications.pearson.com/en/qualifications/edexcel-gcses/sciences-2016.html

(or search 'Edexcel GCSE Science')

…and selecting the 'exam materials' link to take you to this page…

The most recent series (June 2024) are 'padlock-protected'. Ask your exams officer for a log-in username and password to enable you to access them.





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