

Thursday 13 June 2013 – Morning

GCSE ADDITIONAL APPLIED SCIENCE

A192/02 Science of Materials and Production (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

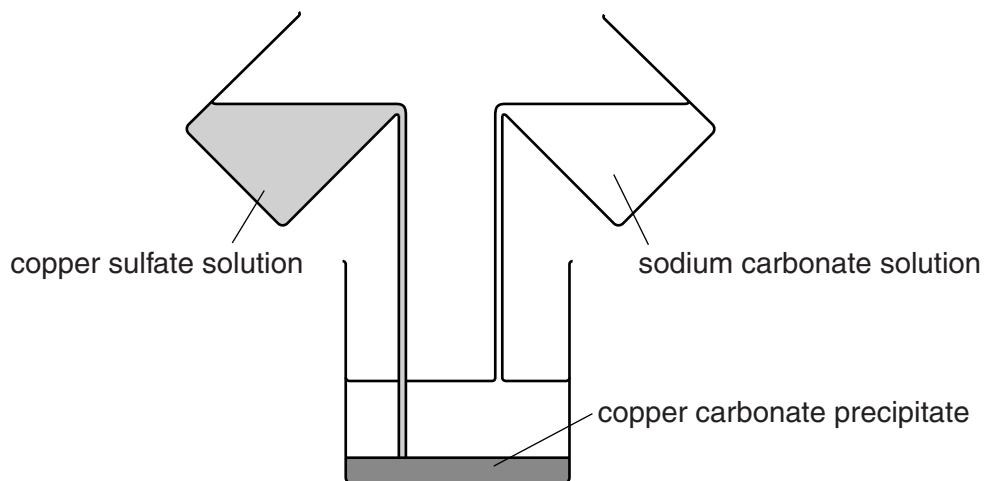
- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **50**.
- This document consists of **16** pages. Any blank pages are indicated.

This paper has been pre modified for carrier language

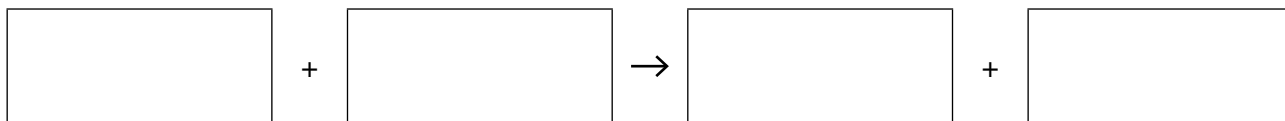
Answer **all** the questions.

- 1 Vince uses a batch process to manufacture the blue-green pigment copper carbonate (CuCO_3). He mixes equal volumes of copper sulfate solution (CuSO_4) and sodium carbonate (Na_2CO_3) solution.

The copper carbonate forms a precipitate.



- (a) Write down the balanced symbol equation for the reaction that Vince is using.



[2]

- (b) Copper sulfate is expensive, so Vince investigates the yield of his process. Vince mixes the **same** volume of the reactants five times, using a different concentration of copper sulfate solution each time. He measures the mass of copper carbonate each time.

Here are his results.

1.0 litres of sodium carbonate solution (concentration in g/l)	1.0 litres of copper sulfate solution (concentration in g/l)	Copper carbonate (mass in g)
100	50	36
100	100	72
100	150	108
100	200	115
100	250	115

- (i) Vince decides to scale up his process to make 920 g of copper carbonate. He uses the 250 g/l copper sulfate solution. Calculate the volume of copper sulfate solution he will need.

volume = litres [2]

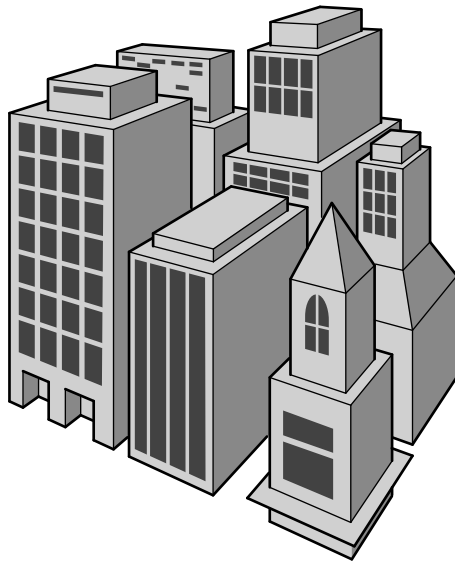
- (ii) He decides to use the 250 g/l copper sulfate solution from now on. Is this the best concentration for him to use? Use his results to justify your answer.

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 [3]

[Total: 7]

2 Stanley designs blocks of flats.



Stanley tries to make sure that people who live in his flats are not disturbed by noisy neighbours. This means that he needs to know how to use materials that can control sound.

Explain the use of suitable materials for controlling the noise from the other flats.



The quality of written communication will be assessed in your answer to this question.

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[Total: 6]

- 3 Sally buys a bag of potatoes from the shop. She is annoyed that it costs more than it did last year.



Explain why the cost of producing potatoes may change from one year to the next.



The quality of written communication will be assessed in your answer to this question.

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[6]

[Total: 6]

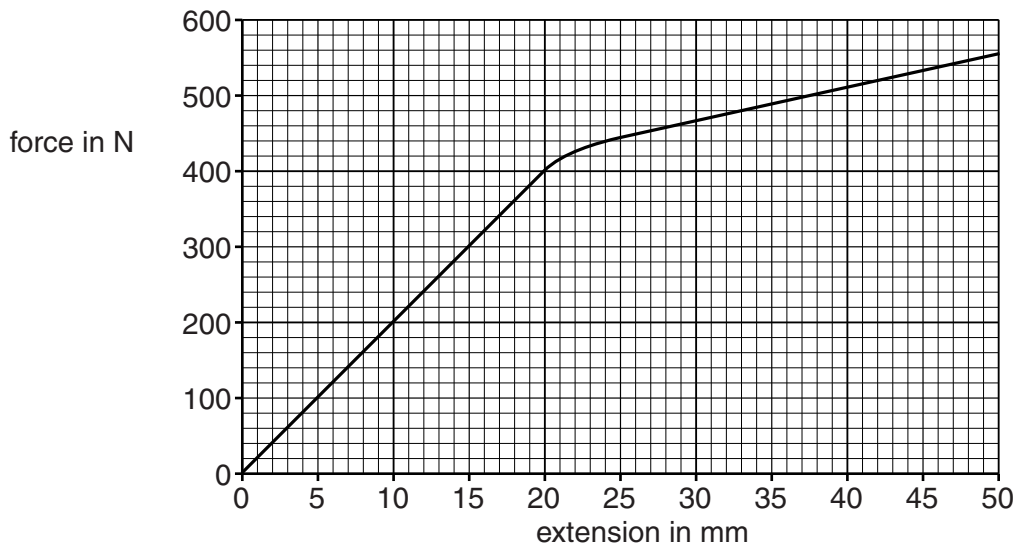
4 Edmund tests climbing ropes.

(a) One rope extends by 5×10^{-3} m when it supports a weight of 250 N.

By calculating its force constant k , predict the extension of the rope when it supports a person of weight 750 N.
Use $F = kx$.

extension = m [2]

(b) Edmund obtains this force-extension graph by hanging weights from the end of a different rope.



(i) If the rope is stretched too much it has plastic behaviour.

What is the largest force which allows the rope to behave elastically?

force = N [1]

(ii) Describe the difference between elastic and plastic behaviour of materials.

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 [2]

7

- (iii) Edmund worries about the energy stored in the rope while it is stretched by the 400 N weight. He knows that 100 J is enough to make the end of the rope lash out dangerously if the weight falls off the end of the rope.
Use calculations to show that he does not need to worry.
1 mm = 0.001 m

[2]

[Total: 7]

5 Susan climbs mountains.



She uses an ice-axe to cut steps in ice.

The cutting head of the ice-axe and the handle are made of different materials.

(a) The cutting head is made of metal.

State and explain **two** properties of metal that make it a suitable material for the cutting head.

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(b) The metal cutting head has a much higher thermal conductivity than the wooden handle.

Explain why this means that the handle feels much warmer than the cutting head when Susan holds them.

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(c) The wood of the handle is a composite material.

Write down the name of **another** composite material and describe its structure.

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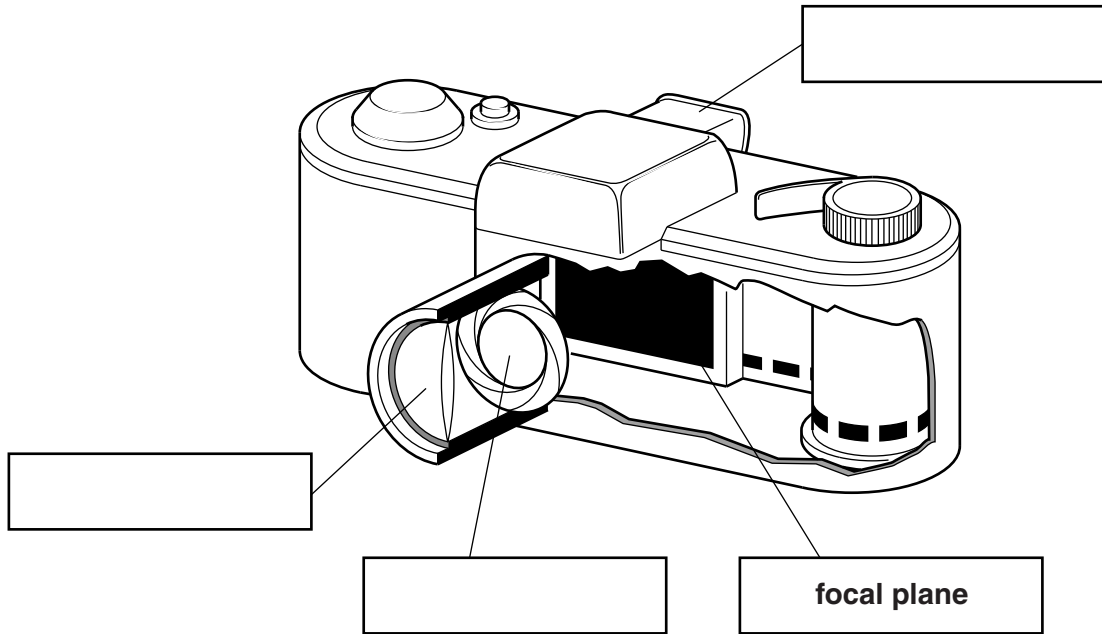
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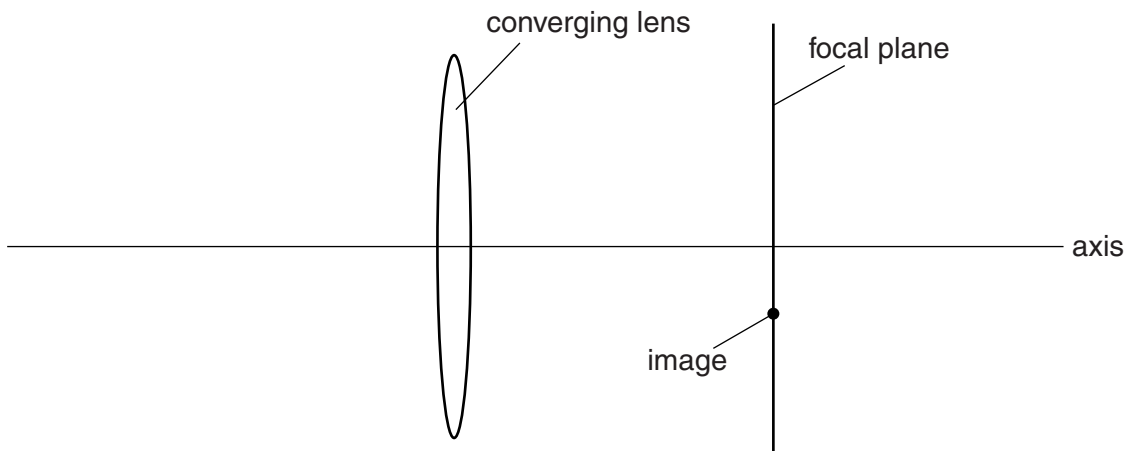
6 Bill has an old camera.

(a) Complete the labels for the camera.



[2]

(b) The diagram shows the position of the image of a distant object formed by a converging lens. The object is too far away to be shown in the diagram.



Draw **two** rays of light from a distant object on the left to show how the lens focuses them to form the image on the right. [2]

(c) Bill has to adjust the lens of his camera as he moves closer to the object he is photographing.

Explain what adjustment he has to make to the lens.

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[Total: 6]

7 Small quantities of blue copper sulfate crystals can be made in the laboratory as follows:

- stir solid copper oxide into dilute sulfuric acid in a beaker, until no more reacts
- use filter paper to separate the unreacted solid from the solution
- heat the solution with a Bunsen burner to evaporate some of the water
- cool the solution on a windowsill and leave until crystals develop
- remove the crystals with tweezers.

Suggest how this procedure can be carried out on an industrial scale.



The quality of written communication will be assessed in your answer to this question.

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[Total: 6]

- 8 Microorganisms are used to make some drinks.
For example, yeast is used to convert grape juice into wine.



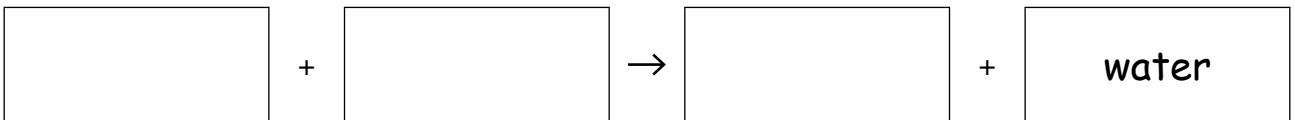
- (a) Yeast creates alcohol (C₂H₅OH) by anaerobic fermentation of a sugar (C₆H₁₂O₆) in the grape juice.

Complete the **balanced** symbol equation for **anaerobic fermentation**.



- (b) Wine is often stored in bottles, with corks to keep out the air.
Wine can be spoiled if the bacteria *Acetobacter* are allowed to grow in it.
Acetobacter converts alcohol to acetic acid by aerobic respiration.

(i) Complete the **word** equation for the **aerobic fermentation** of alcohol to acetic acid.



[1]

- (ii) There are three stages in the development of a population of *Acetobacter* bacteria in a bottle of wine.

In the first stage (lag phase), the bacteria adapt to their new environment.

Describe and explain the other two stages.

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..... [2]

(iii) Sometimes the *Acetobacter* bacteria are already in the bottle before the wine is added.

Here are some suggestions for preventing *Acetobacter* in the bottle from spoiling the wine.

Put ticks (✓) in the boxes next to **two** suggestions that would work.

Keep the wine above room temperature.

Filter the wine as it goes into the bottle.

Wash the bottle before filling it with wine.

Make sure that air cannot get past the cork.

Boil the wine before it goes into the bottle.

[1]

[Total: 6]

END OF QUESTION PAPER

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