

NAME: _____ FORM/GROUP _____

DESIGN AND TECHNOLOGY REVISION BOOKLET

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WORLD ASSOCIATION OF TECHNOLOGY TEACHERS <https://www.facebook.com/groups/254963448192823/> www.technologystudent.com © 2017 V.Ryan © 2017

SMART MATERIALS AND MODERN MATERIALS

General Questions on a selection of smart materials
Shape Memory Alloys (SMA) and Muscle Wire
Modern Material - Polymorph

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SUITABLE REVISION MATERIAL FOR:

**PRODUCT DESIGN
RESISTANT MATERIALS
GRAPHIC PRODUCTS
DESIGN AND TECHNOLOGY**

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SMART MATERIALS

LINK TO HELP AND INFORMATION

<https://www.technologystudent.com/joints/smarty1.html>

1. Explain what is meant by the term 'smart material'. **3 marks**

2. Name a smart material and name / describe a product in which it is used.

SMART MATERIAL:

PRODUCT / DESCRIPTION:

3. Explain why the smart material you named is used in the product.

4. Describe / explain the following smart materials: **6 x 3 marks (total 18 marks)**

HYDROCHROMIC INKS:

POLYMORTH:

SHAPE MEMORY ALLOYS (SMA):

HYDROMORPHIC POLYMERS:

HYDROCARBON ENCAPSULATING POLYMERS:

AROMA PIGMENTS:

SMART MATERIALS - SHAPE MEMORY ALLOY (SMA)

LINK TO HELP AND INFORMATION

<https://www.technologystudent.com/equip1/sma1.htm>

5a. Complete the following paragraphs about SMA, by adding the missing words, in the correct places. The words listed at the bottom of the page will help you answer this question. **11 marks**

SMA wire is sometimes called ' _____ ', as it is composed of _____ and _____. On first site this special wire looks like ordinary wire and even has many of the same properties. It can be _____ to form complex shapes quite easily and it _____ electricity. However, it is very expensive when compared to ordinary steel or even copper wire. However, it has properties that make it very special:

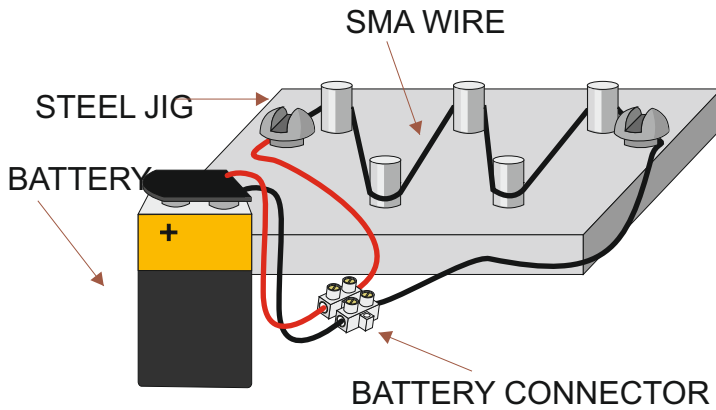
The wire has a _____ - for example, if it is folded to form a shape and then heated above _____ (centigrade) it returns to its _____ shape.

The material can also be ' _____ ' to remember a shape. This can be achieved by folding the wire to a particular shape and clamping it in position. The wire is then heated for a approximately _____ at precisely 150 degrees or pass an electric current through the _____ wire. If the wire is now folded into another shape and then placed in hot water it returns to the original 'programmed' shape.

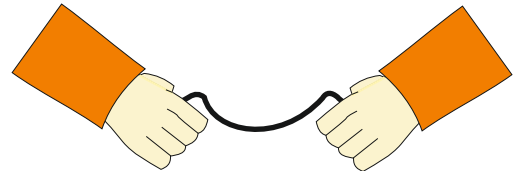
conducts original nickel programmed titanium five minutes
memory Nitinol 90 degrees folded SMA

5b. Below are diagrams that represent programming the shape of SMA wire and returning it to its original shape. Add notes to each diagram to help explain each stage. **3 x 4 marks (total 12 marks)**

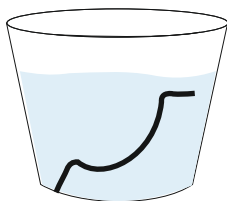
1.



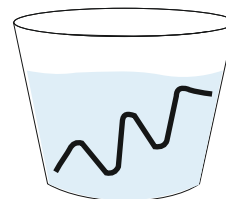
2.



3.



4.



MODERN MATERIAL - POLYMORPH

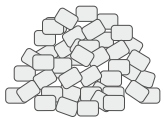
LINK TO HELP AND INFORMATION

<https://www.technologystudent.com/equip1/poly1.htm>

6a. Polymorph is a thermoplastic material that can be shaped and reshaped any number of times. Below are diagrams representing the stages involved in moulding the material. Add notes below each stage to help explain each process. **4 X 6 marks (total 24 marks)**

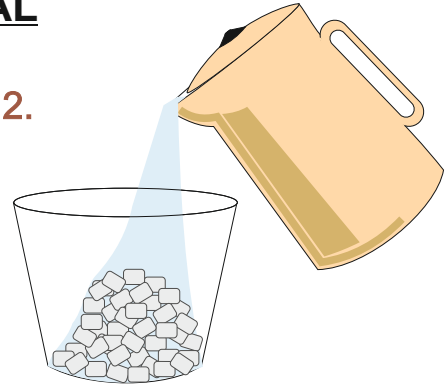
NOTE !!! POLYMORPH IS NOW CLASSIFIED AS A MODERN MATERIAL

1.



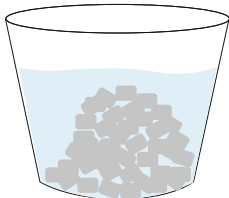
POLYMORPH GRANULES

2.



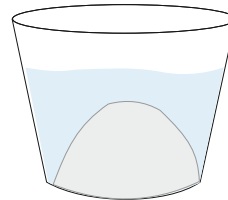
ADD HOT WATER

3.



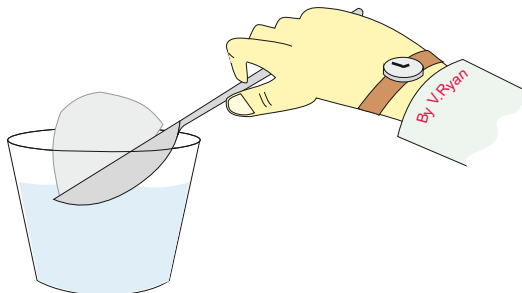
GRANULES SLOWLY JOIN TOGETHER

4.



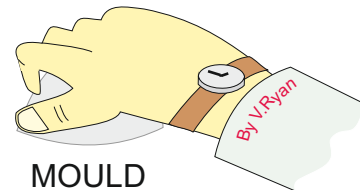
MASS OF POLYMORPH

5.



REMOVE POLYMORPH

6.



MOULD POLYMORPH GRANULES

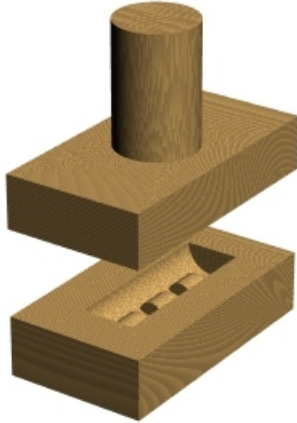
MODERN MATERIAL - POLYMORPH

LINK TO HELP AND INFORMATION

<https://www.technologystudent.com/equip1/sma2.htm>

6b. Below are a set of incomplete diagrams representing the way polymorph can be shaped using a mould to form a screwdriver handle. Add diagrams to stage 2,3,4 and 5. Include explanatory notes underneath each stage. 4 x 5 marks (total 20 marks)

1.



PREPARE MOULD ON
CNC MACHINE

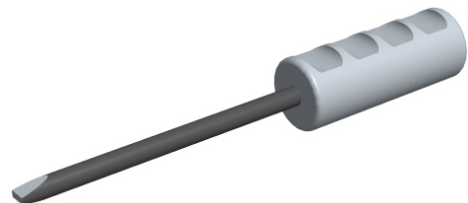
2.

3.

4.

5.

6.



ADD SCREWDRIVER BLADE
FOR REALISM
