

# SAMPLE DESIGN AND TECHNOLOGY GCSE EXAMINATION PAPER

## MARK SCHEME / CRITERIA

*Guidance for marking in italics.  
Most of all use your professional  
discretion.*

### 2 HOURS ALLOWED

#### Materials required for this examination:

- normal writing and drawing instruments
- a calculator
- a protractor.

#### Instructions to candidates:

- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

#### Information

- The marks for questions are displayed.
- The maximum mark for this paper is 120.
- There are 22 marks for Section A, 32 marks for Section B and 66 marks for Section C.

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# CORE TECHNICAL PRINCIPLES - SECTION A

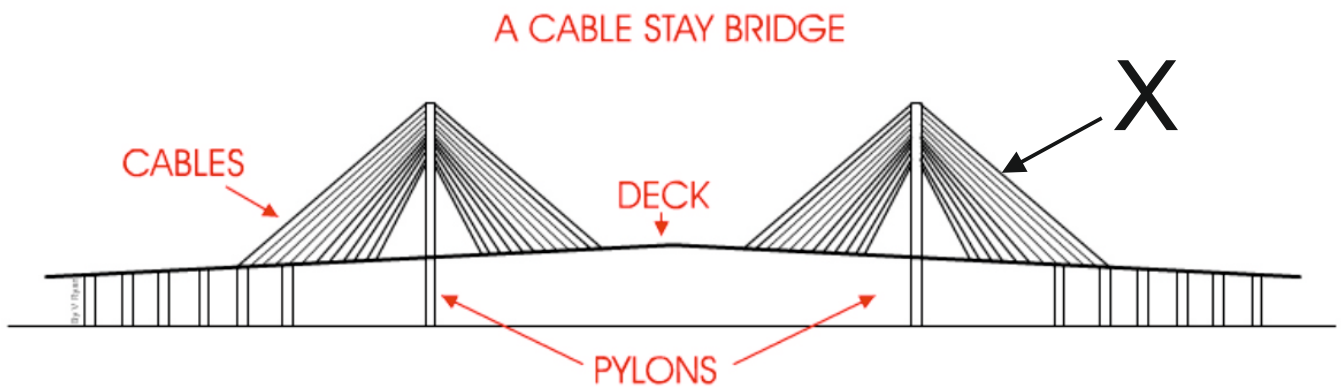
The questions to follow are multiple choice. Tick one answer for each question.

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**1. A house alarm system has a number of outputs and inputs. Identify an OUTPUT from the selection below.**

- A. Movement sensor
- B. Key pad
- C. Siren
- D. Magnetic door sensor

**2. The drawing below shows a simple drawing of a bridge. What is the force applied to part X.**



- A. Tension
- B. Compression
- C. Torsion
- D. Shear

**3. Which of the following metal is a non-ferrous metal?**

- A. Steel
- B. Copper
- C. Iron
- D. Stainless Steel

#### 4. From the list of materials, identify the metal alloy.

- A. Copper
- B. Chromium
- C. Stainless steel
- D. Lead

#### 5. Which of the following systems, means the production of ONE item?

- A. Prototype manufacture.
- B. Continuous Manufacture
- C. Batch production
- D. Mass manufacture

#### 6. Which of the following statements is true?

- A. Pine is a manufactured material
- B. Zinc is used to protect metal from corrosion
- C. MDF means 'Middle, Density, Foam'
- D. QC mean 'Quality Counts'

#### 7. Which of the statements below is The definition of the physical property 'Elasticity'?

- A. The ability of a material to stand up to forces being applied without it bending, breaking, shattering or deforming in any way.
- B. The ability of a material to change shape (deform) usually by stretching along its length.
- C. The ability of a material to stretch without breaking or snapping.
- D. The ability of a material to absorb force and flex in different directions, returning to its original position.

**8. Designers consider 'sustainability' as one important aspect of design. What is sustainability?**

- A. A product that is designed to use once.
- B. Materials that can be naturally replenished / regrown.
- C. Finite materials are the only materials used in the manufacture of a product
- D. Sustainability means involving the customer at all stages of design

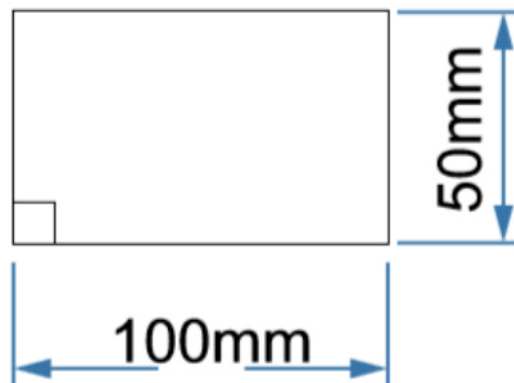
  
  
  

**9. Which of the following 'finishes' is used for woods.**

- A. Anodising.
- B. Chemical Blacking.
- C. Galvanising
- D. Shellac

**10. What is the area of the rectangle shown below?**



- A. 500mm<sup>2</sup>
- B. 50000mm<sup>2</sup>
- C. 5000mm<sup>2</sup>
- D. 5500mm<sup>2</sup>

TO HELP YOU ANSWER  
THIS QUESTION

<http://www.technologystudent.com/rmflsh1/pine2.html>

**11. Describe / explain two properties of natural Pine, that makes it ideal for the construction industry. 2 marks**

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*One mark for each property  
which may include those  
mentioned opposite*

**Mechanical Properties:** Medium crushing strength. Medium bending strength. Difficult to split.

**Working Properties:** The timber works easily and well with both hand and machine tools; can be stained, painted, varnished or polished satisfactorily.

TO HELP YOU ANSWER  
THIS QUESTION

[http://www.technologystudent.com/despro\\_fllsh/charity9.html](http://www.technologystudent.com/despro_fllsh/charity9.html)

**12. Corrugated card is used extensively in the manufacture of packaging. Why is this the case - list two reasons below. 2 marks**

*One mark for each reason including  
those seen opposite*

Relatively cheap to manufacture. Can be recycled. Durable material and can withstand knocks and drops. Good strength to weight ratio. Supplied in a range of colours. protects the product inside.

TO HELP YOU ANSWER  
THIS QUESTION

<http://www.technologystudent.com/energy1/solar7.htm>

**13. Solar power is one form of alternative energy, that is becoming popular. Give two reasons for its increase in popularity. 2 marks**

*one mark for each reason  
- including those reasons  
seen opposite.*

The technology is cost effective. Panels can be fitted to roofs easily. Grants are sometimes available. Reduces the owners electricity bill. Energy produced contributes to the national grid. Reduces reliance on fossil fuels. Clean and environmentally friendly. easy to install.

TO HELP YOU ANSWER  
THIS QUESTION

<http://www.technologystudent.com/energy1/solar7.htm>

**14. Give two reasons why some people are not in favour of solar energy production. 2 marks**

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*One mark for each reason including those reasons mentioned opposite.*

1. Solar energy can only be harnessed when it is daytime and sunny.
2. Solar collectors, panels and cells are relatively expensive to manufacture although prices are falling rapidly.
3. Solar power stations can be built but they do not match the power output of similar sized conventional power stations. They are also very expensive.
4. In countries such as the UK, the unreliable climate means that solar energy is also unreliable as a source of energy. Cloudy skies reduce its effectiveness.
5. Large areas of land are required to capture the sun's energy. Collectors are usually arranged together especially when electricity is to be produced and used in the same location.
6. Solar power is used to charge batteries so that solar powered devices can be used at night. However, the batteries are large and heavy and need storage space. They also need replacing from time to time.

TO HELP YOU ANSWER  
THIS QUESTION

<http://www.technologystudent.com/pdf14/ratios1.pdf>

PAGE 12

**15. This question is about alternative energy. A local wind farm produces 4 terawatt hours of electricity over a year. At the same time, a solar farm produced 0.5 terawatt hours of electrical power. What is the ratio Wind farm : Solar Power ? Include an explanation of your working out. 4 marks**

WIND FARM : SOLAR POWER  
4 : 0.5

WIND FARM : SOLAR POWER  
4 : 0.5

To ensure that final ratio is in whole numbers, divide the wind power total by the solar power total.

$$\frac{\text{WIND FARM}}{\text{SOLAR POWER}} = \frac{4}{0.5} = 8$$

Then take the answer and place it on the wind power side of the ratio and the 1 on the solar power side.

WIND FARM : SOLAR POWER  
8 : 1

*2 marks for the calculation and 2 for the explanation.*

*Discretion to be shown as to the detailed required.*

# SECTION B - Specialist Technical Principles

Natural Pine Board  
300mm X 20mm X 3000mm

Steel Round  
Section 50mm Dia.

Acrylic Round  
Section 50mm Dia.

**16. Select one of the stock forms listed above.**

**Identify the stock forms primary source (where it comes from) 1 mark**

Name of Stock Form \_\_\_\_\_ Stock form must be identified

Primary Source (where it comes from) \_\_\_\_\_ 1 mark for source clearly identified: e.g. forest, woodland, iron ore, oil, crude oil etc...

**In the space below, explain how the primary source material is converted to the stock form you have selected. 4 marks**

TO HELP YOU ANSWER  
THIS QUESTION  
(Natural Pine)

<http://www.technologystudent.com/joints/forest3a.html>  
<http://www.technologystudent.com/joints/forest4a.html>  
<http://www.technologystudent.com/joints/wdprocess1.html>

*1 mark for very limited answer*  
*2 marks for little detail including a sketch and limited notes / labels*  
*3 marks for clear sketch and good notes*  
*4 marks for detailed answer including sketch and detailed notes.*

**17. Describe two ways in which natural woods are given a 'finish' to enhance and protect their surface. 2 x 2 marks**

TO HELP YOU ANSWER  
THIS QUESTION

[http://www.technologystudent.com/despro\\_fish/mats\\_finish1.html](http://www.technologystudent.com/despro_fish/mats_finish1.html)

Finish 1:

*2 marks for a recognised finish with description. See link above for possible answers. 1 mark allowed for named finish without description*

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Finish 2:

*2 marks for a recognised finish with description. See link above for possible answers. 1 mark allowed for named finish without description*

**18. Select one of the products shown in the table below. Then, describe two of the features that mean it is suitable for manufacture on a production line. 2 x 2 marks**

<p><b>STEEL CHAIR</b></p>  <p>TO HELP YOU ANSWER THIS QUESTION</p>	<p><b>PACKAGE</b></p>  <p>TO HELP YOU ANSWER THIS QUESTION</p>	<p><b>POLYPROP CHAIR</b></p>  <p>TO HELP YOU ANSWER THIS QUESTION</p>
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TO HELP YOU ANSWER  
THIS QUESTION

<http://www.technologystudent.com/prddes1/barcelona2.html>

<http://www.technologystudent.com/grp08/pack1.html>

<http://www.technologystudent.com/prddes1/polyprop2.html>

PRODUCT:

*Product must be clearly identified for any marks.*

FEATURE 1:

*1 mark for limited description.*

*2 marks for detailed description*

*See links above for detailed info on each product.*



FEATURE 2:      *1 mark for limited description.*  
                     *2 marks for detailed description*

*See links above for detailed info on each product.*

**19. For the product you selected in question 18 - name and describe one of the industrial processes used in it's manufacture. 5 marks**

TO HELP YOU ANSWER  
THIS QUESTION

<http://www.technologystudent.com/prddes1/barcelona2.html>  
<http://www.technologystudent.com/grp08/pack1.html>  
<http://www.technologystudent.com/prddes1/polyprop2.html>

INDUSTRIAL PROCESS: \_\_\_\_\_

DESCRIPTION OF MANUFACTURING PROCESS  
INCLUDE NOTES AND A SKETCH(S)

*1 mark for very basic sketch or notes*  
*1 mark for name of process*  
*2 marks for limited sketch and notes / labels*  
*3 to 5 marks for more detailed sketch / notes*

*See links above for detail on the processes*

**20. Circle one of the materials and its associated product. Then, explain why the material has physical properties, making it suitable for the manufacture of the product 2 x 2 marks**

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*Plywood - Chair*

*Steel tube - bench*

*PCB (Printed Circuit Board) - Circuit found in electronic products*

*Metal Foam - Crumple Zone on a train carriage.*

*Copper - Pipes for domestic water supply*

TO HELP YOU ANSWER  
THIS QUESTION

Follow the links below.

Plywood - Chair - <http://www.technologystudent.com/prddes1/eames6.html>  
[http://www.technologystudent.com/despro\\_fish/flexply1.html](http://www.technologystudent.com/despro_fish/flexply1.html)  
<http://www.technologystudent.com/joints/plywood1.html>

Steel tube - bench - <http://www.technologystudent.com/joints/steelbnch1.html>

PCB (Printed Circuit Board) - Main circuit found in electronic products -  
<http://www.technologystudent.com/pcb/pcb1a.htm>  
<http://www.technologystudent.com/pcb/wave1.html>

Metal Foam - Crumple Zone on a train carriage -  
[http://www.technologystudent.com/joints\\_fish/metalfoam1.html](http://www.technologystudent.com/joints_fish/metalfoam1.html)  
[http://www.technologystudent.com/joints\\_fish/metalfoam2.html](http://www.technologystudent.com/joints_fish/metalfoam2.html)

Copper - Pipes for domestic water supply -  
<http://www.technologystudent.com/designpro/metals1.htm>  
<http://www.technologystudent.com/joints/nonferrous1.html>

Property 1:

*Product must be circled to be awarded any marks*

*one mark for basic description of a property.*

*two marks for a detailed description of a property.*

*Follow the links for detailed description of properties.*

Property 2:

21. Designers often select materials based on their environmental impact and the expectations of potential customers. For example, materials that can be recycled, are preferred to those that are non-recyclable.

How are the following materials and strategies regarded as an ethical choice? **10 marks**

### **MATERIALS**

Sustainable timber

Polylactide

Biopol

Oxodegradable Polymers

### **STRATEGIES**

The 6Rs

Recycling - Upcycling - Closed loop recycling

Life Cycle Analysis

Replacing the Materials Economy

TO HELP YOU ANSWER  
THIS QUESTION

Follow the links below.

### **MATERIALS**

Sustainable timber

<http://www.technologystudent.com/prddes1/susenv1.html>

Polylactide

<http://www.technologystudent.com/joints/pla1.html>

Biopol

<http://www.technologystudent.com/prddes1/biopola.html>

Oxodegradable Polymers

[http://www.technologystudent.com/joints\\_fish/oxodegrad1.html](http://www.technologystudent.com/joints_fish/oxodegrad1.html)

### **STRATEGIES**

Reduce, Reuse, Refuse

[http://www.technologystudent.com/prddes1/rev\\_card\\_three\\_rs.html](http://www.technologystudent.com/prddes1/rev_card_three_rs.html)

Recycling - Upcycling - Closed loop recycling -

<http://www.technologystudent.com/prddes1/closetloop1.html>

<http://www.technologystudent.com/prddes1/upcycling1.html>

Life Cycle Analysis - <http://www.technologystudent.com/prddes1/lifecy1.html>

Replacing the Materials Economy -

[http://www.technologystudent.com/prddes\\_2/matecon1.html](http://www.technologystudent.com/prddes_2/matecon1.html)

*Reference must be made to each material to gain full marks. reference must be made to each strategy mentioned in the question.*

*Discretion of the examiner with regards to the detail and marks awarded.*

*1-2 marks for very basic understanding of the issues/strategies.*

*3-5 marks for reasonable understanding of the issues/strategies.*

*6-8 marks awarded for detailed understanding .*

## **SECTION C - DESIGNING AND MAKING PRINCIPLES**

A typical task light is shown below



### **SPECIFICATION**

REQUIREMENT 1: The office / task light must be manufactured from fully recyclable materials.

REQUIREMENT 2: The task / office light will be based on an Art Movement.

REQUIREMENT 3: The task / office light must be stable, when adjusted in any possible lighting position.

TO HELP YOU ANSWER  
THIS QUESTION

Follow the links below.

[http://www.technologystudent.com/joints\\_fish/office8.html](http://www.technologystudent.com/joints_fish/office8.html)

TO HELP YOU ANSWER THIS QUESTION Follow the link below.

[http://www.technologystudent.com/joints\\_flash/office6.html](http://www.technologystudent.com/joints_flash/office6.html)

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**22a. Evaluate the task light in terms of the materials you think have been used to manufacture the product. 4 marks**

*Marks awarded for:*

*Sample answer: This task light has a heavy cast aluminium base which adds to the stability of the light. The pine arms are lightweight and completely recyclable, an ideal choice for this task light. The oxide blackened wingnuts, allow for easy adjustment and the finish prevents corrosion. The black oxide finish is also quite an attractive feature. Lightweight, thin gauge aluminium sheet has been used for the 'shade'. It is completely recyclable and has been spun into a shape that focuses the light, on a specific area.*

*Examiner to use professional discretion regarding mark*

**23b. Evaluate the task light in terms of the strength and stability of the product. 4 marks**

*Marks awarded for:*

*Sample answer. The light will be stable because of its heavy cast aluminium base. The adjustment may be easy but the wingnuts may not hold the right in position, unless they are thoroughly tightened. The choice of quality materials means that the product should last for many years.*

*Include possible mention of centre of gravity*

*Examiner to use professional discretion regarding mark*

TO HELP YOU ANSWER THIS QUESTION Follow the link below.

[http://www.technologystudent.com/joints\\_flash/office6.html](http://www.technologystudent.com/joints_flash/office6.html)

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**23c. Evaluate the task light in terms of it's aesthetics and style. 4 marks**

*Marks awarded for:*

*The style is modernist, with an environmental twist. The materials are fully recyclable and they have been machined to a high standard. The aluminium base and pine arms compliment each other. This is an appealing design, for any home or office. The 'colours' of the natural wood and machined aluminium, are attractive features.*

*One mark per reference to style / aesthetic quality.*

**23d. Evaluate the task light in terms of the products functionality. 4 marks**

*Marks awarded for:*

*The light functions well, as it can be adjusted into a variety of positions. The wingnuts are possibly a weak point, as they may allow the joints to move, if not fully tightened. The shade also has limited adjustment, although care must be taken if the light is on, as the shade will soon heat up.*

*one mark per function.*

TO HELP YOU ANSWER THIS QUESTION Follow the links below.

<http://www.technologystudent.com/designpro/ergo1.htm>  
[http://www.technologystudent.com/despro\\_flsh/revise11.html](http://www.technologystudent.com/despro_flsh/revise11.html)  
[http://www.technologystudent.com/despro\\_flsh/ergorest1.html](http://www.technologystudent.com/despro_flsh/ergorest1.html)

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**24a. What is anthropometrics and why do designers regard it as essential, when designing? 4 marks**

*One mark per fact / example, relating to anthropometrics.*

*What is ANTHROPOMETRICS ?*

*The study of the human body and its movements.*

*The study of the human body and its movement, often involving research into measurements relating to people. It also involves collecting statistics or measurements relevant to the human body, called Anthropometric Data. The data is usually displayed as a table of results, diagram or graph. Anthropometric data is used by designers and architects.*

**24a. What is ergonomics and why do designers regard it as essential, when designing? 4 marks**

*One mark per fact / example, relating to anthropometrics.*

*The study of people and their relationship with the environment around them.*

*Measurements, also known as 'anthropometric data', are collected and applied to designs / products, to make them more comfortable to use. The application of measurements to products, in order to improve their human use, is called Ergonomics.*



TO HELP YOU ANSWER THIS QUESTION Follow the link below.

[http://www.technologystudent.com/joints\\_flash/office13.html](http://www.technologystudent.com/joints_flash/office13.html)

**25. With the aid of a sketch and notes, describe two anthropometric measurements that could be applied to an improved task light design. 2 x 4 marks**

NOTES

SKETCHES

MEASUREMENT 1:

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*Up to two marks for notes and two for the sketch.*

*Follow link above for example.*

MEASUREMENT 2:

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*Up to two marks for notes and two for the sketch.*

*Follow link above for example.*

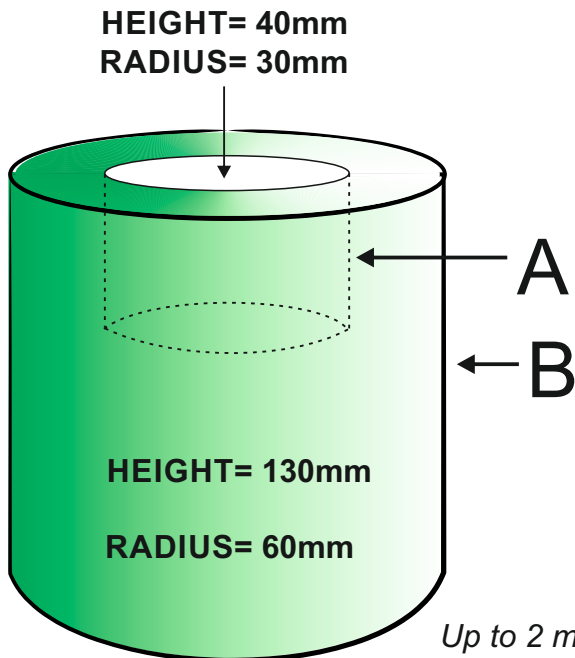
TO HELP YOU ANSWER THIS QUESTION Follow the link below.

[http://www.technologystudent.com/pdf14/maths\\_cylinder1.pdf](http://www.technologystudent.com/pdf14/maths_cylinder1.pdf)

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**26. The solid cylindrical object seen below is being considered as a component for the task light. It is engineered from mild steel, with a large machined 'blind' hole, in the top surface.**

**Calculate the volume of the engineered object. 5 marks**



The cylindrical object is treated as two separate cylinders.

Part A is the 'Blind' hole.  
Part B is the cylinder.

*Up to 2 marks for Part A and another 2 marks for Part B.*

*Additional mark for the correct final answer.*

#### PART A

$$v = \pi r^2 h$$

$$\text{volume} = 3.14 \times 30\text{mm} \times 30\text{mm} \times 40\text{mm}$$

$$\text{volume} = 113040\text{mm}^3$$

or

$$\text{volume} = 113.040\text{cm}^3$$

#### PART B

$$v = \pi r^2 h$$

$$\text{volume} = 3.14 \times 60\text{mm} \times 60\text{mm} \times 130\text{mm}$$

$$\text{volume} = 1469520\text{mm}^3$$

or

$$\text{volume} = 1469.520\text{cm}^3$$

Then subtract the volume of part A from the volume of part B, to find the overall volume of the engineered object.

$$\text{FINAL VOLUME} = B - A$$

$$\text{FINAL VOLUME} = 1469520\text{mm}^3 - 113040\text{mm}^3$$

$$\text{FINAL VOLUME} = 1356480\text{mm}^3 \text{ or } 1356.48\text{cm}^3$$

TO HELP YOU ANSWER THIS QUESTION Follow the link below.

[http://www.technologystudent.com/joints\\_flesh/office8.html](http://www.technologystudent.com/joints_flesh/office8.html)

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**27. Three specification requirements for the Task Light are written below. Underneath each requirement, write an explanation. The first point has been completed for you. 2 x 4 marks**

REQUIREMENT 1: The office / task light must be manufactured from fully recyclable materials.

EXPLANATION: When the office / task light comes to the end of its working life, there will be a need to dismantle the light and recycle the materials. The materials can either down-cycled into lower quality products OR reused for spare parts OR up-cycled into higher value products. This will help to protect the environment and attract environmentally conscious customers.

REQUIREMENT 2: The task / office light will be based on an Art Movement.

*Follow the link for sample answers to Requirement 2 and 3.*

*Award a mark for each relevant point raised.*

REQUIREMENT 3: The task / office light must be stable, when adjustable to any possible lighting position.

*Follow the link for sample answers to Requirement 2 and 3.*

*Award a mark for each relevant point raised.*

TO HELP YOU ANSWER THIS QUESTION Follow the link below.

<http://www.technologystudent.com/designpro/newspec1.html>

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**28. Designers spend time writing a justified specification. What is the purpose of a specification? 2 marks**

*1 mark per relevant statement:*

*Sample: A series of relevant statements summarising the purpose/functions of the product, Client requirements are usually included and reference to general sizes, materials, ergonomic requirements etc....*

TO HELP YOU ANSWER THIS QUESTION Follow the link below.

<http://www.technologystudent.com/designpro/model1.htm>

**29. Why do designers make a model, before full production of the product takes place? 2 marks**

*1 mark per relevant statement e.g:*

- 1. Making a model allows the designer to physically see the idea in 3D form.*
- 2. It helps the designer identify potential faults and correct them as well as make further improvements.*
- 3. It allows the designer to experiment with a range of materials, eventually selecting the best materials for the chosen design. Sometimes it is a good idea to make a selection of models from a range of materials. This allows the designer to experiment before purchasing expensive materials for the actual manufactured product.*
- 4. It allows a simple evaluation of the design by the designer and potential customers.*
- 5. It is easier to record the views of others by showing them a 3D scaled model rather than a 'flat 2D' drawing.*
- 6. A 3D model can be passed around a table of people who form a customer focus group.*

TO HELP YOU ANSWER THIS QUESTION Follow the links below.

<http://www.technologystudent.com/prddes1/modmat1.html>  
<http://www.technologystudent.com/prddes1/modemat2.html>

**30. Name a material suitable for modelling? 1 marks**

*1 mark for naming a relevant material e.g. Styrofoam, clay.....*

TO HELP YOU ANSWER THIS QUESTION Follow the links below.

<http://www.technologystudent.com/gprep07/phortho4.html>

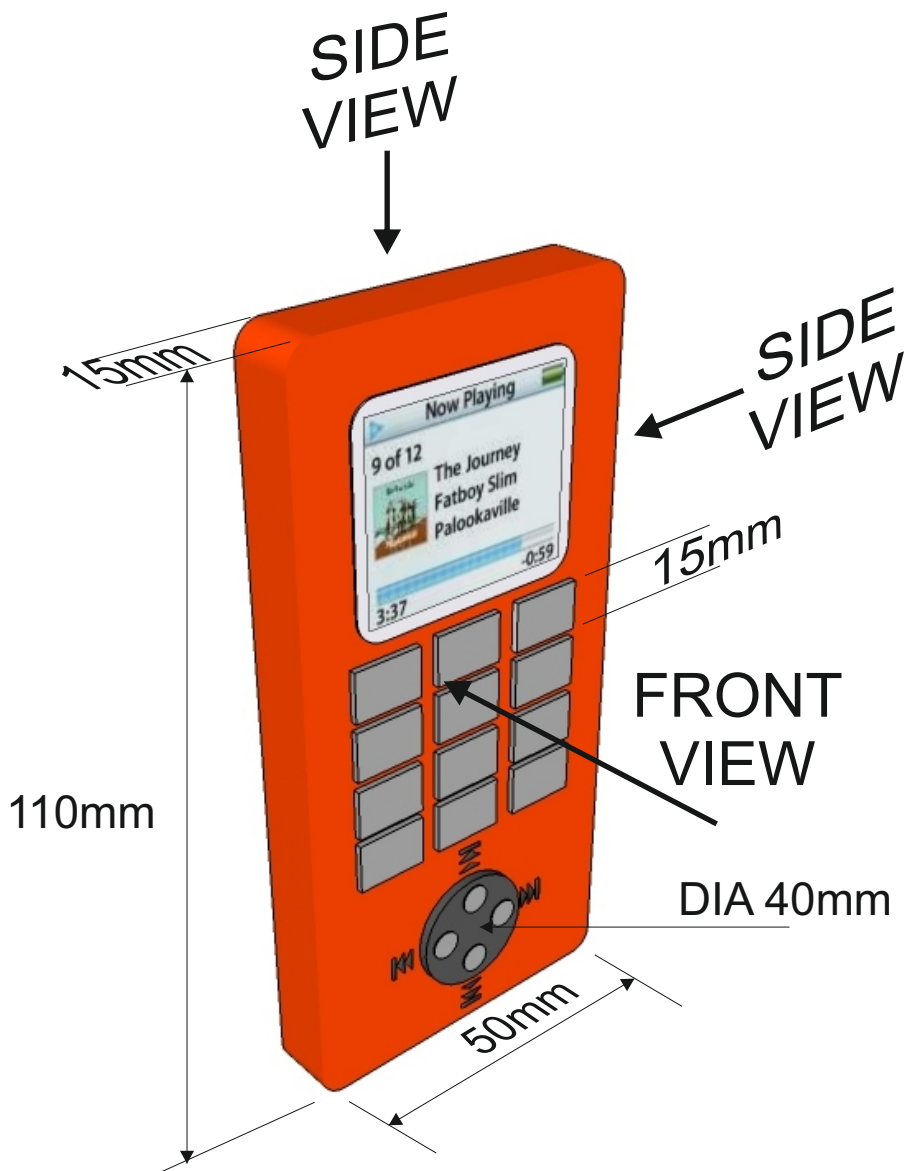
<http://www.technologystudent.com/gprep07/phortho11.html>

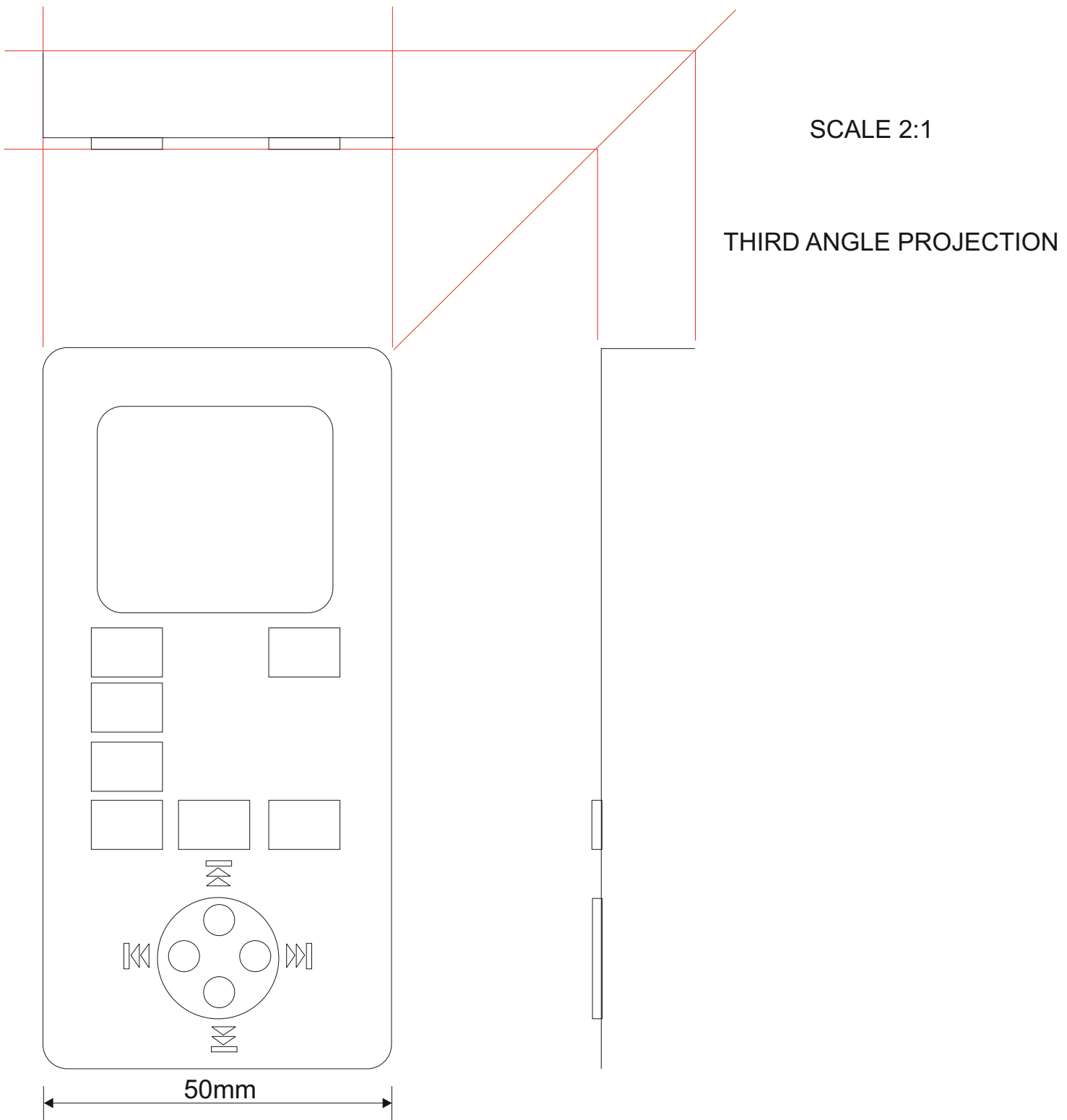
31. A typical mobile phone is shown below. This is drawn in perspective (3D).

1. Complete the orthographic drawing (on the next page) of the same mobile phone, in third angle orthographic projection. Show all your construction lines.

2. Add five dimensions

3. Add the symbol for third angle orthographic projection. 8 marks





*For full marks - Complete the orthographic drawing of the same mobile phone, in third angle orthographic projection. Showing all your construction lines. up to 4 marks*

*2. Add five dimensions up to 2 marks*

*3. Add the symbol for third angle orthographic projection. up to 2 marks*

TO HELP YOU ANSWER THIS QUESTION Follow the link below.  
[http://www.technologystudent.com/despro\\_fish/smartphone1.html](http://www.technologystudent.com/despro_fish/smartphone1.html)

**32. Study the three views of the mobile phone seen opposite. Using the isometric grid at the bottom of the page, sketch an accurate 3D version.**

**Add realistic colour and detail.**

**8 marks**



*Up to 4 marks for a completed accurate 3D sketch*

*Up to 4 marks for realistic colour and detail.*

*Examiner to use professional discretion*

