

**Wednesday 25 January 2012 – Morning**

**GCSE DESIGN AND TECHNOLOGY**

**Electronics and Control Systems: Mechanisms**

**A514/03** Technical Aspects of Designing and Making

Candidates answer on the Question Paper.

**OCR supplied materials:**

None

**Other materials required:**

- A calculator may be used

**Duration:** 1 hour 15 minutes



Candidate forename		Candidate surname	
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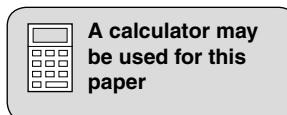
Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- 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 in Section A **and** Section B.
- 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).
- Show all your working out for calculations.
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- 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 **60**.
- Marks will be awarded for the use of correct conventions.
- Dimensions are in millimetres unless stated otherwise.
- Your Quality of Written Communication will be assessed in questions marked with an asterisk (\*).
- This document consists of **16** pages. Any blank pages are indicated.



Section A

Answer **all** questions.

1 Fig. 1 shows a rotating compost making machine.

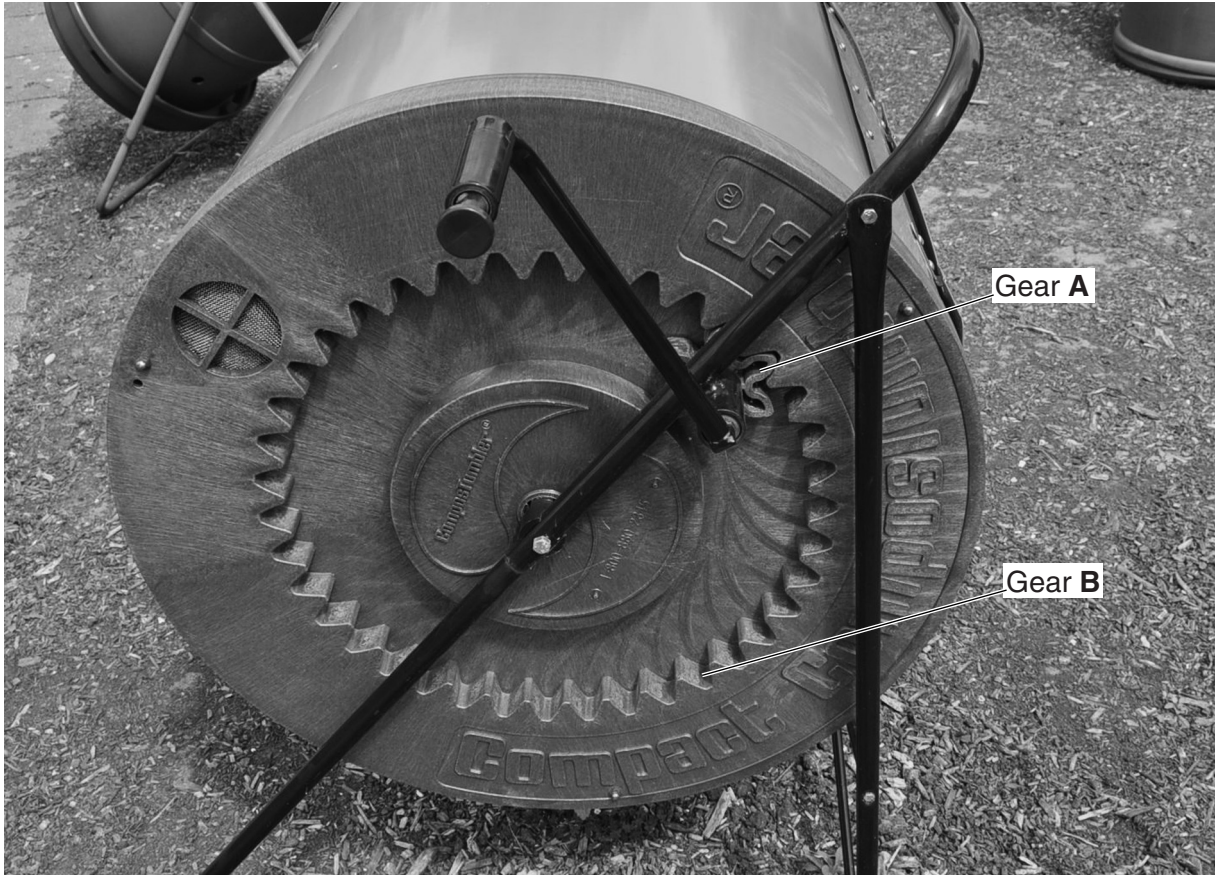


Fig. 1

(a) The drum is loaded with materials for making compost and the handle is rotated to mix the contents.

(i) Give **two** benefits of using human power to operate a product.

1 .....

2 ..... [2]

(ii) Name a suitable plastics material for making the drum.

..... [1]

(iii) Give **one** reason for your choice of material.

..... [1]

(b) (i) Calculate the velocity ratio of the pair of gears **A** and **B** shown in Fig. 1.

Gear **A** has 6 teeth, gear **B** has 36 teeth.

Use the formula  $VR(\text{gear ratio}) = \text{number of teeth on driven} / \text{number of teeth on driver}$ .

.....  
.....  
..... [2]

(ii) If gear **A** is rotated at 30 rpm, calculate the rpm of gear **B**.

.....  
.....  
..... [2]

(iii) 'Gearing down' is the term often used when a small gear drives a larger gear.

State **one** benefit of 'gearing down' the drum in Fig. 1.

.....  
..... [1]

(c) Add sketches and notes to Fig. 2 to show how the drum may be driven from the motor.

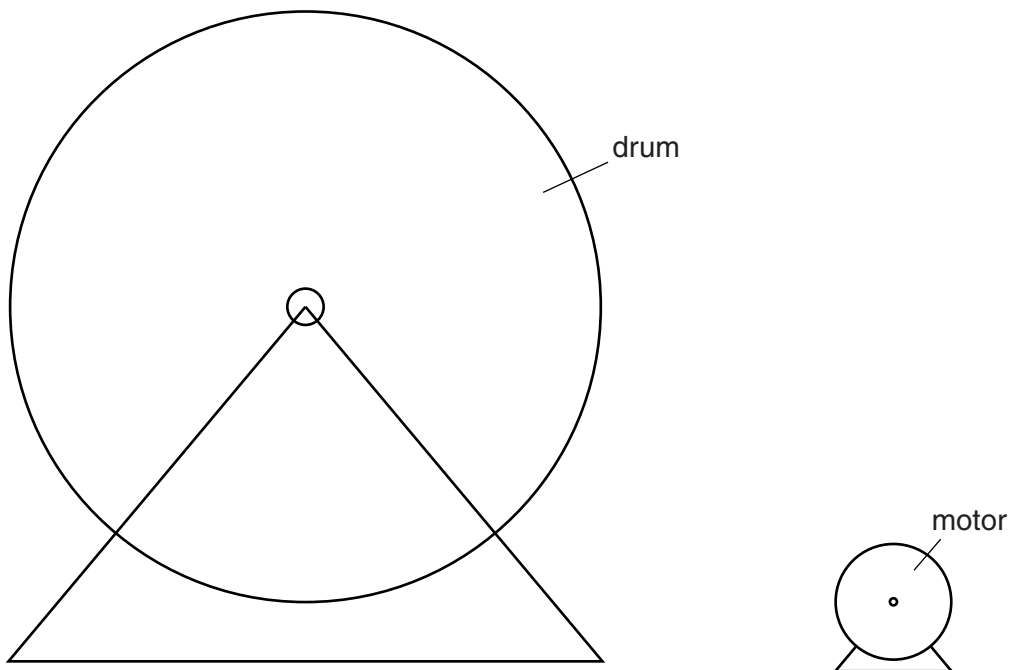


Fig. 2

[3]

[Total: 12]

- 2 Fig. 3 shows a powered rotary wire brush used for cleaning corroded steel.



**Fig. 3**

- (a) State **two** safety precautions when using the tool shown in Fig. 3.

1 .....

2 ..... [2]

- (b) Steel can be prevented from corroding by a number of different means. The table below gives three methods of preventing steel from corroding. Complete the table.

Method	Advantage	Disadvantage
Zinc plating	Protects steel even if scratched	
Powder coating		
Spray painting		Wastes paint and solvent

[4]



3 Fig. 4 shows a nut cracker.

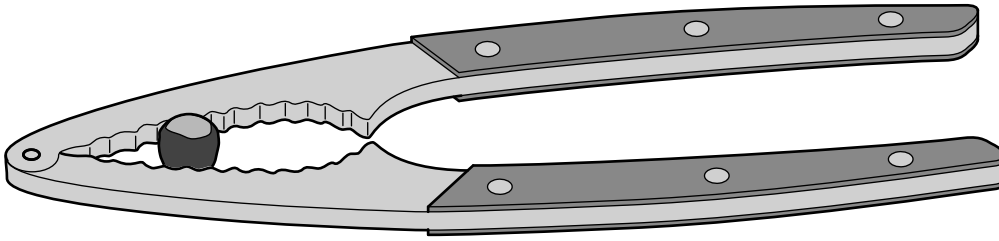


Fig. 4

(a) (i) Indicate clearly on Fig. 4:

- effort
- fulcrum
- load

[3]

(ii) State the class of lever used by the nut cracker.

..... [1]

(iii) The metal jaws of the nut cracker have a polished finish.  
Aluminium alloy is too soft for the jaws.  
Name a suitable metal alloy for the jaws.

..... [1]

(iv) The nut cracker has wooden handles.  
Give **one** reason why wood is used for the handles.

..... [1]

(b) The effort, fulcrum and load points of an engine crane are shown in Fig. 5.

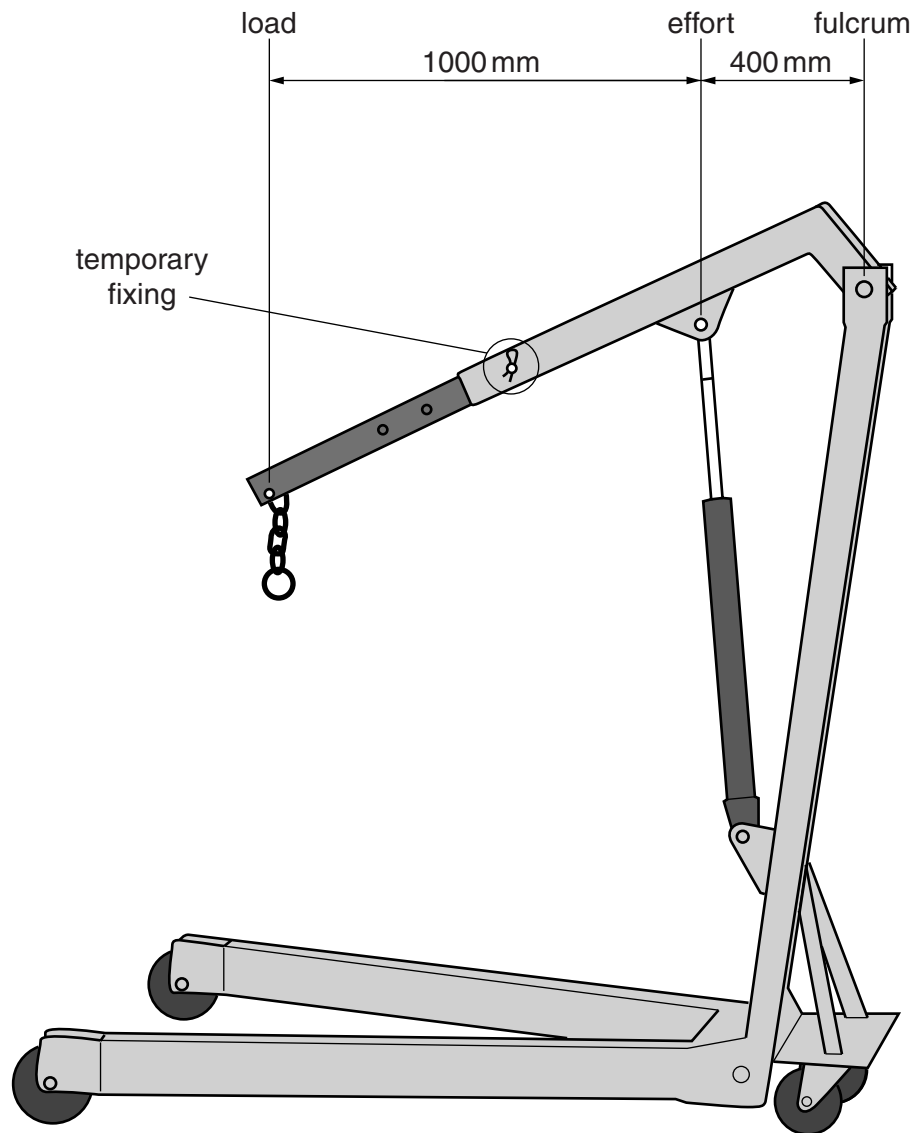


Fig. 5

- (i) The hydraulic jack exerts an effort of 500 N.  
Calculate the force applied to the load hook.

Use the formula below

Moment = force  $\times$  distance

In equilibrium  $M_c = M_{ac}$

$M_c$  = clockwise moment  $M_{ac}$  = anticlockwise moment

.....

.....

..... [2]



Fig. 6 shows a type of temporary fixing.

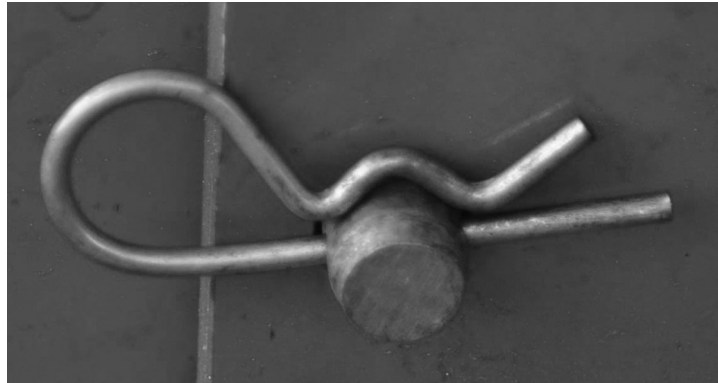


Fig. 6

(ii) Name the fixing shown in Fig. 6.

..... [1]

(iii) State **one** benefit of the fixing shown in Fig. 6.

..... [1]

(iv) State **one** benefit of using nylon for the wheels of the engine crane shown in Fig. 5.

..... [1]

(v) The legs of the engine crane can be folded up after use.  
State **one** benefit to the manufacturer of this feature.

..... [1]

[Total: 12]

Section B

Answer **all** questions.

- 4 Fig. 7 shows an animated model of a pecking chicken. The model is operated by pressing down at **X**.

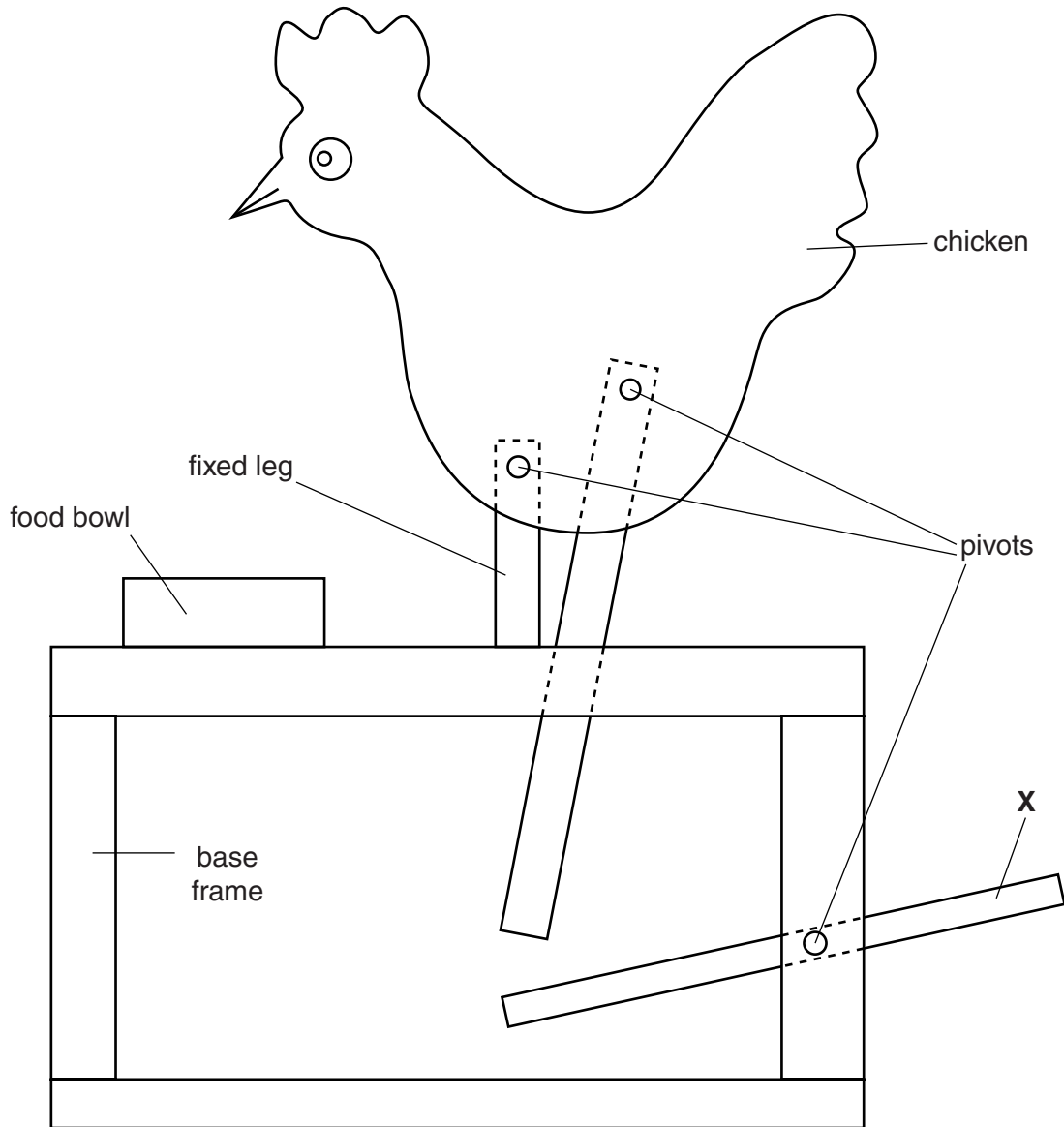


Fig. 7

- (a) State the order of lever used to operate the mechanism.

..... [1]

- (b) Show on Fig. 7, by drawing **four** arrows, the movements made by the model.

[4]

- (c) Jigs and templates are often used when repetition and accuracy are required during manufacturing.

In the space below design a jig for drilling the two holes in the chicken body.

[4]

- (d) (i) Toys often include the phrase 'unsuitable for children under 36 months old'.

Give **two** reasons why a toy may be unsuitable for children under 36 months old.

1 .....

.....

2 .....

..... [2]

- (ii) The use of lead in paints is banned in the UK.

State the reason for this.

.....

..... [1]

[Total: 12]

5



Fig. 8a

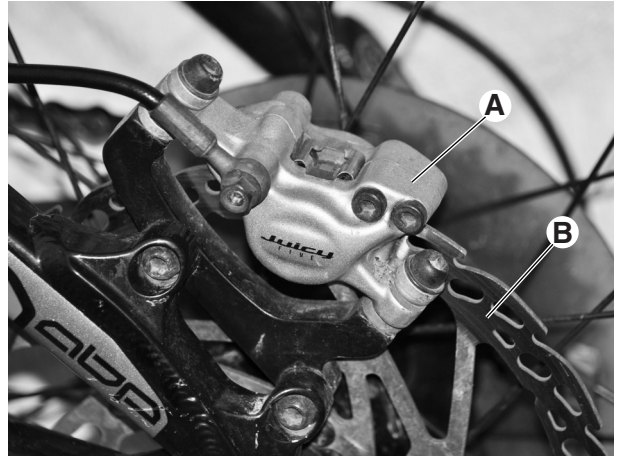


Fig. 8b

(a) Fig. 8a shows an off-road bicycle.  
 Fig. 8b shows a close-up of a part of the bicycle rear braking system.

(i) Name the components labelled **A** and **B**

**A** .....

**B** ..... [2]

(ii) Component **B** has holes cut into it during manufacture.

Give **one** reason for this.

.....

..... [1]

Fig. 9 shows competitor numbers used during cycle races. A Radio Frequency Identification Device (RFID) is fitted to each number.

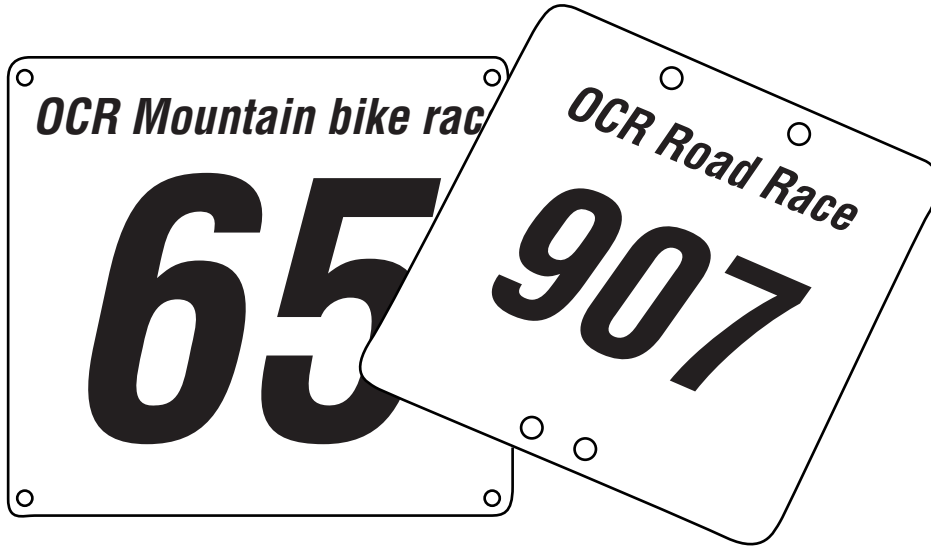


Fig. 9

(b) Give **three** benefits of RFIDs to the organisers and competitors in a race.

- 1. ....  
.....
  - 2. ....  
.....
  - 3. ....  
.....
- [3]



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