

Candidate Name	Centre Number	Candidate Number



**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**General Certificate of Secondary Education**

**DESIGN AND TECHNOLOGY  
(SYSTEMS AND CONTROL TECHNOLOGY)**

**1957/8**

**PAPER 8: MECHANISMS  
HIGHER TIER**

**Specimen Paper 2003**

Additional materials:      Formulae Sheet OCR (Tables 2)

**TIME** 1 hour 15 minutes

**INSTRUCTIONS TO CANDIDATES**

Write your name, Centre number and candidate number in the boxes above.

Answer **all** questions.

Write your answers, in blue or black ink, in the spaces provided on the question paper.

Read each question carefully and make sure you know what you have to do before starting your answer.

Show all your working out for calculations.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets [ ] at the end of each question or part question.

Marks will be awarded for the use of correct conventions.

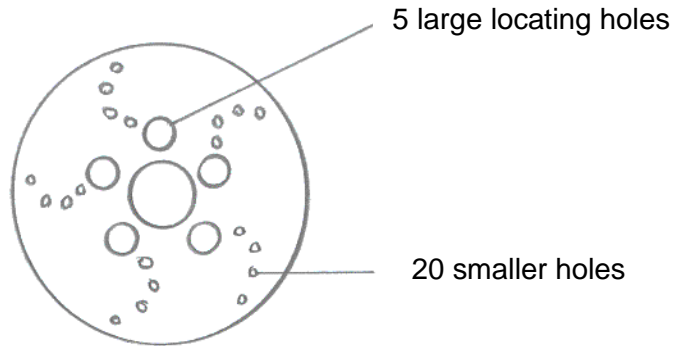
Dimensions are in millimetres unless stated otherwise.

Total marks for this paper is **50**.

Question Number	For Examiner's use only
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>TOTAL</b>	

1 The Go-kart uses a disc brake for a braking system.

Fig. 1 shows details of the disc rotor.



**Fig.1**

(a) The disc rotor has holes machined into it.

Give **two** reasons why the holes are produced.

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[2]

(b) The designer produced a number of different layouts of the holes using C.A.D.

Give **two** benefits of using C.A.D. for the designer.

Benefit 1 \_\_\_\_\_

[1]

Benefit 2 \_\_\_\_\_

[1]

(c) The disc rotor is machined using C.A.M.

Give **one** benefit of using C.A.M. to the manufacturer other than cost.

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[1]

- (d) The rotors are made from a round bar of steel.

Which type of C.N.C machine would be most suitable to machine the disc rotor to the correct diameter?

\_\_\_\_\_

[1]

- (e) After the disc rotor has been machined to the correct diameter the holes are then machined out.

Which type of C.N.C. machine would be most suitable for machining out these holes?

\_\_\_\_\_

[1]

- (f) The disc rotors are to be produced using a 'Just in Time' commercial production method.

Give a benefit of using a Just in Time manufacturing system for this product.

\_\_\_\_\_

[1]

- (g) The rotors are produced using a 'Cell Production' system. The cell is responsible for quality control.

Give **two** critical control points, which the cell would need to set up.

Critical control point 1 \_\_\_\_\_

[1]

Critical control point 2 \_\_\_\_\_

[1]

2 Fig. 2 shows the parts of the braking system.

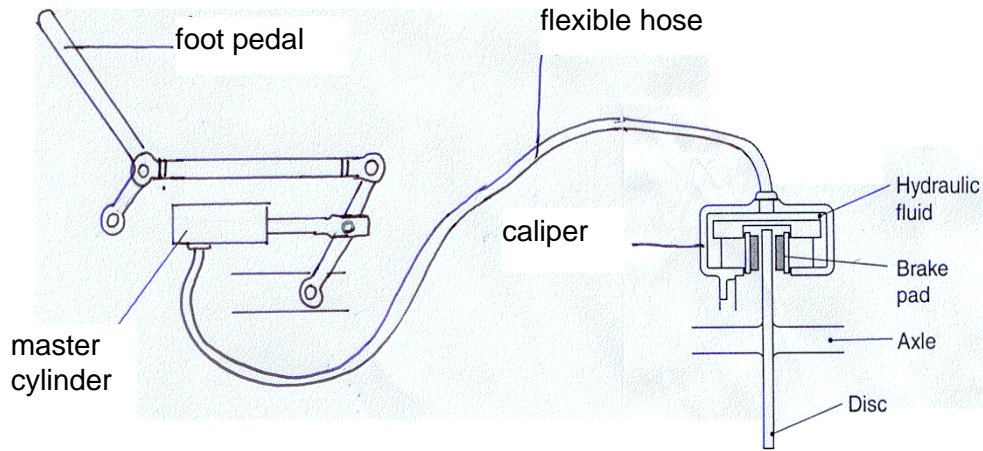


Fig. 2

(a) One criteria point for the specification of the system is given below.

Complete the specification by adding **three** more criteria points.

Criteria 1 - The brake pads must be easy to change

Criteria 2 - \_\_\_\_\_ [1]

Criteria 3 - \_\_\_\_\_ [1]

Criteria 4 - \_\_\_\_\_ [1]

(b) Explain how anthropometric data would be used to make sure the design was safe to operate.

\_\_\_\_\_  
\_\_\_\_\_ [1]

- (c) The brake system works effectively but the pedal needs to be pushed very hard.

Using notes and sketches show a development that could be made to the design to make it easier to produce a greater force to operate the brake.

[4]

- (d) The brake pads were previously made from asbestos but are now replaced by ceramic pads.

Give **two** reasons why asbestos pads are no longer used.

Reason 1 \_\_\_\_\_ [1]

Reason 2 \_\_\_\_\_ [1]

3 Fig. 3 shows the arrangement of the power system for a Go-kart

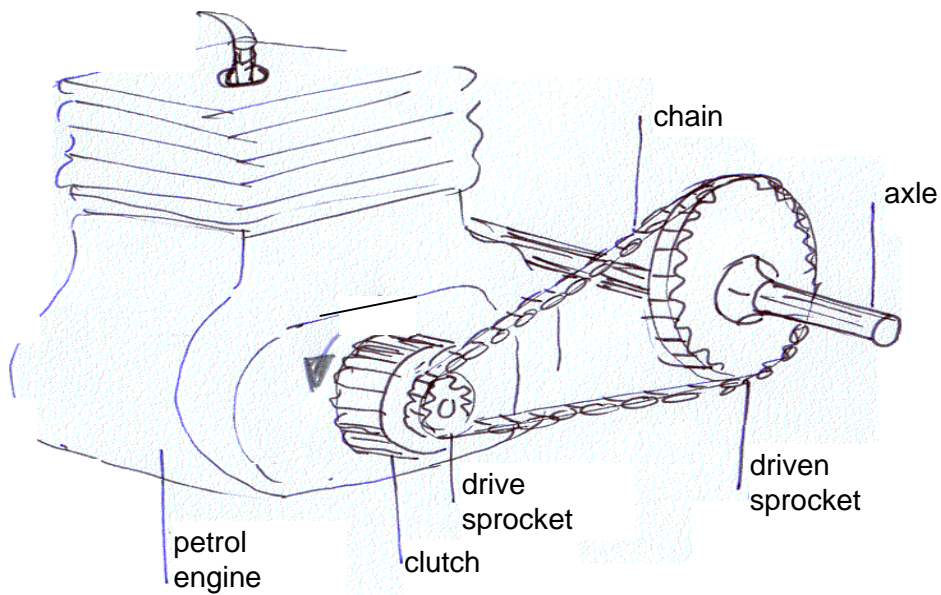


Fig. 3

Fig. 4 shows a simplified version of the cam and follower arrangement that opens and closes the valves of the engine.

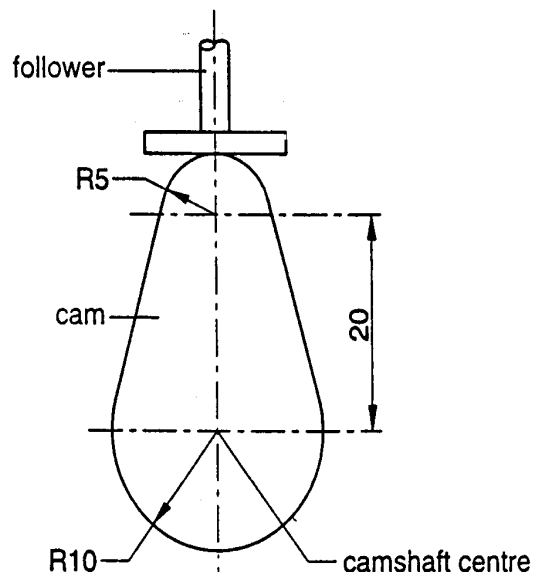


Fig. 4

- (a) (i) On Fig.4 clearly mark the dwell angle. [1]
- (ii) Calculate the throw on the cam.

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[1]

**(b)** Cams are often used to convert rotary motion to reciprocating motion.

In the space below draw and label a different mechanism that converts rotary motion to reciprocating motion.

[4]

**(c)** Name a suitable type of clutch for use in the Go-kart.

\_\_\_\_\_

[1]

**(d)** Explain the purpose of the clutch in the power system.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[3]

- 4 Fig. 5 shows the final stage of transmission and speed reduction inside the differential gearbox in a full size car.

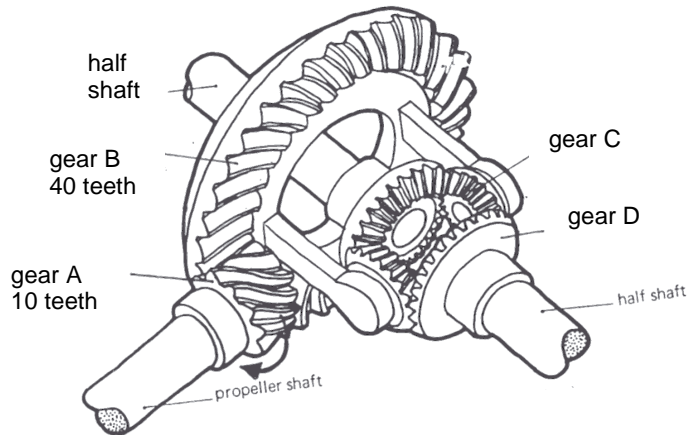


Fig. 5

- (a) The arrow on gear A shows the direction it rotates. Add arrows to Fig, 5 to show the direction the gears C and D rotate. [1]

- (b) (i) Name the type of gears labelled C and D \_\_\_\_\_ [1]

- (ii) A and B are crossed helical gears.

Give **two** reasons for the choice this type of gears.

Reason 1 \_\_\_\_\_ [1]

Reason 2 \_\_\_\_\_ [1]

- (c) In fourth gear the propeller shaft rotates at 3000 r.p.m.

Calculate the speed of gear B (show all of your working out)

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[3]



- (d) Draw and label a diagram to show a method that can be used to attach gear X to the propeller shaft.

**[3]**

5 Fig. 6 shows a motor vehicle screw jack.

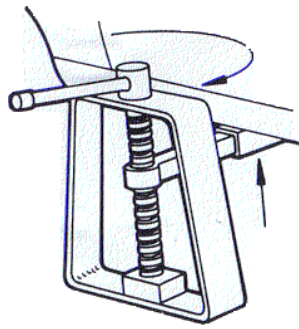
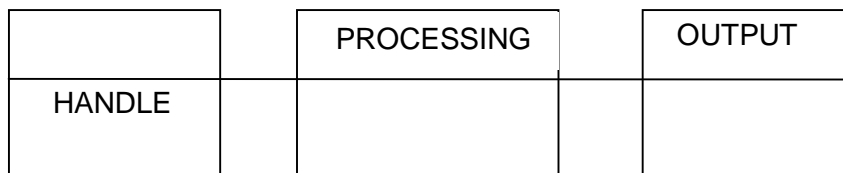


Fig. 6

(a) An incomplete block diagram for the mechanical jack system to lift a motor vehicle is shown below. Complete the block diagram by adding the missing words.



[3]

(b) Fig. 7 shows an alternative design for a motor vehicle jack.

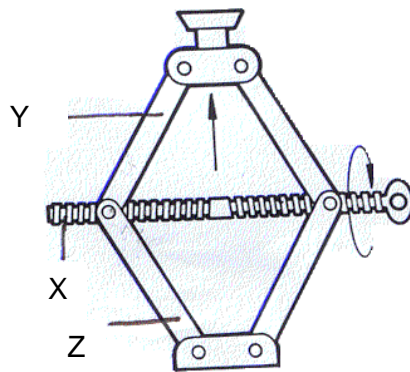


Fig. 7

Explain briefly the major similarities and major differences between the two jack systems shown in Fig. 6 and Fig. 7.

Similarities \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

Differences \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(c)** Fig. 7 does not show how part X is attached to parts Y and Z.

In the space below use notes and sketches design a simple and safe method to connect these parts.

**[3]**

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PAPER 8: MECHANISMS OPTION

HIGHER TIER

MARK SCHEME

**Specimen Paper 2003**

- 1 (a) location holes allow disc to be attached to axle flange  
additional holes are for cooling  
1 mark for each answer, max 2 marks [2]
- (b) designs can be altered rapidly  
producing the drawings is faster than by hand  
dimensions are added automatically  
1 mark for each answer, max 2 marks [2]
- (c) accuracy of finish  
faster machining (saves time)  
material requirement planning (M.R.P.)  
automatic control of the machines removes repetitive manual jobs  
1 mark for each answer, max 1 mark [1]
- (d) C.N.C. Lathe [1]
- (e) C.N.C. Milling machine [1]
- (f) less storage of stocks  
less time wasted moving stocks around the factory  
stock does not become redundant due to changes in the design  
1 mark for each answer, max 1 mark [1]
- (g) thickness of the rotors  
diameter of the rotors  
number of holes  
position of the holes  
1 mark for each answer, max 2 marks [2]
- [Total: 10]**
- 2 (a) the linkages must move freely (low friction)  
the joints in the linkages must not wear  
the master cylinder must produce sufficient amplification of pressure  
the foot pedal must give sufficient amplification of movement (leverage)  
the foot pedal must be of a length to fit to the driver's foot  
the seals must not leak  
the flexible hose must resist the hydraulic pressure  
the disk must be able to be attached/ detached from the axle  
the pistons must move freely in the bores  
there must be a means of attaching the caliper to the Go-kart  
1 mark for each answer, max 3 marks [3]
- (b) the length of the distance from the heel to the ball of the drivers foot gives the  
length for the foot pedal [1]
- (c) greater ratio of distance between A-B to B-C (2 marks)  
quality of notes (1 mark)  
quality of sketches (1 mark) [4]
- (d) danger of asbestosis to mechanics/ driver  
danger of pollution to refuse/ landfill sites  
danger of asbestosis to workers at the manufacturing company  
1 mark for each answer, max 2 marks [2]
- [Total: 10]**

- 3 (a) (i) dwell angle correctly marked [1]
- (ii) throw = highest (25) – smallest (10) = 15 [1]
- (b) crank and slider (2 marks)  
quality of sketch (1 mark)  
correct labels (1 mark) [4]
- (c) centrifugal clutch [1]
- (d) enables the rotating engine crank to be easily connected and disconnected to the drive shaft (2 marks)  
allows the crankshaft to engage at a given speed (1 mark) [3]
- [Total:10]**
- 
- 4 (a) C = clockwise AND D = anticlockwise [1]
- (b) (i) bevel gears [1]
- (ii) turn the direction of motion through 90 degrees  
smoother running (less friction) than bevel gears  
less noise generated  
1 mark for each answer, max 2 marks [2]
- (c) V.R =  $10/40 = 1/4$  or 0.25
- input r.p.m. = 3000
- output r.p.m. =  $3000 \times 0.25 = 750$
- units = r.p.m. [3]
- (d) splined shaft  
quality of drawing  
notes/ labels  
1 mark for each answer, max 3 marks [3]
- [Total: 10]**

- 5 (a) input  
screw thread  
car movement  
1 mark for each answer, max 3 marks [3]
- (b) SIMILARITIES  
both use screw thread to process movement  
both use human input  
both have vertical movement as output  
both use rotational movement as input  
1 mark for each answer, max 2 marks [2]
- DIFFERENCES  
scissor jack uses linkages (parallelogram)  
scissor jack gives greater amplification of movement  
scissor jack requires less force to lift a certain distance  
scissor jack requires greater number of turns to lift a certain distance  
screw jack fits into a recess in the car body  
scissor jack is placed under a chassis member  
1 mark for each answer, max 2 marks [2]
- (c) suitable solid rectangular shaped block with threaded hole and means of attachment to the linkages e.g. rivets  
quality of sketch  
labels/ notes  
1 mark for each answer, max 3 marks [3]
- [Total: 10]