

Engineering Science

Mechanisms & Structures

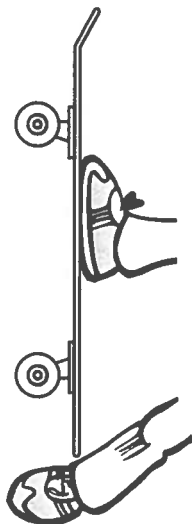
Revision Questions

Name:-.....

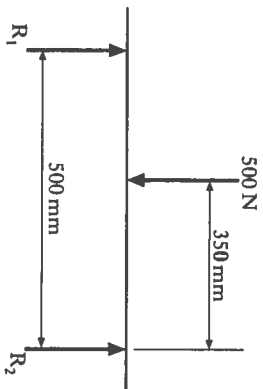
Class Teacher:-.....

Date:-.....

1 A skateboarder is shown below.



The diagram below shows the forces and distances on the skateboard.



(a) State the name given to the type of diagram shown above.

1

0

(b) (i) Calculate, by taking moments about R_2 , the size of the reaction force R_1 .

(ii) Calculate the reaction force R_2 .

3

2

1

0

2

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Bearings are used in the wheels of a skateboard to reduce friction.

(c) State **one** other method which can be used to reduce friction.



1

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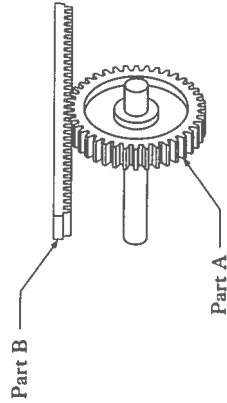
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8. (continued)

(c) (i) Calculate, by taking moments about R_2 , the size of the reaction R_1 .

(ii) Determine the size of the reaction R_2 .

(d) (i) The container is moved using the mechanical system shown below.



State the names of the parts of the mechanical system.

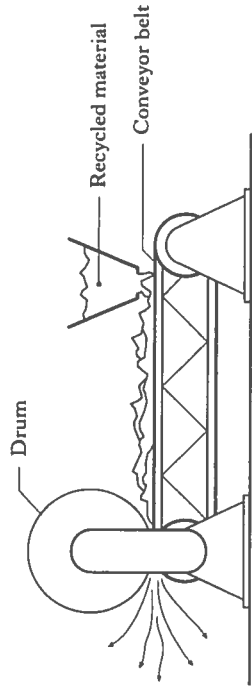
Part A _____

Part B _____

(ii) State the change in motion that this mechanism produces.

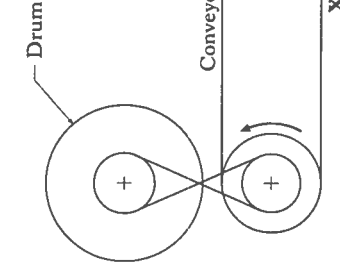
2
1
0
2
1
0

2 A conveyor belt system is used in a recycling process.



(a) Indicate (✓) on the tables below the direction of movement of the conveyor belt and the drum.

Drum direction		
	<input type="checkbox"/>	<input type="checkbox"/>



Conveyor belt direction at X		
	<input type="checkbox"/>	<input type="checkbox"/>

Three different types of belt are shown below.



(1) V belt



(2) Flat belt



(3) Toothed belt

(b) State which belt (1, 2 or 3) is used for:

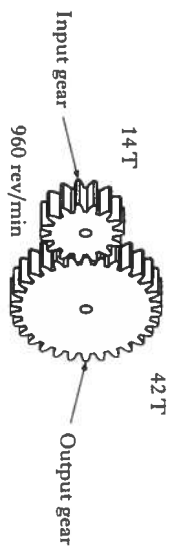
(i) crossed belt drives;

(ii) positive (non-slip) drives.

1
0
1
0

2 (continued)

An electric motor drives the conveyor belt system through a simple gear train.



(c) Calculate the speed of the output gear when the input gear rotates at 960 rev/min.

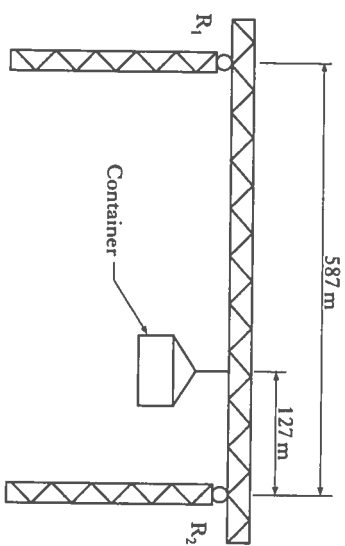
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2
1
0

Turn over

8. The structure shown below is used to transport a 5000 kg container.



(a) Calculate the weight of the 5000 kg container.

(b) Draw the Free Body Diagram of the structure, showing all forces and distances. (Ignore the weight of the beam.)

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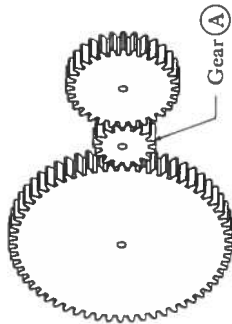
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2
1
0

3
2
1
0

7 (continued)

The conveyor belt is driven by a gear drive, part of which is shown below.



(c) State **one** advantage of using a gear drive over a belt drive.

1
0

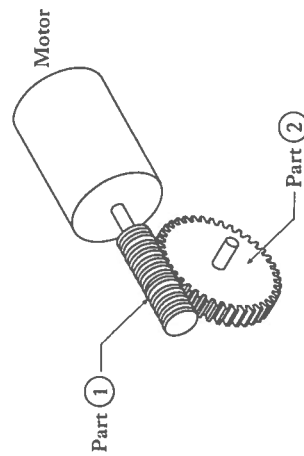
(d) (i) State the name of Gear (A).

1
0

(ii) Describe the effect Gear (A) has on the output speed **and** direction of the mechanism.

2
1
0

Another part of the system makes use of the mechanism shown below.



(e) State the name of the two parts of the mechanism shown above.

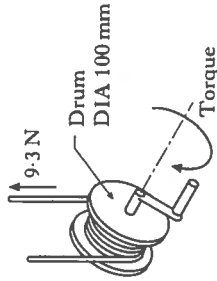
2
1
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Part 1

Part 2

3

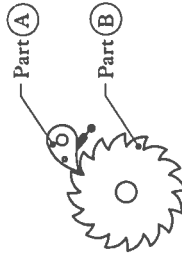
The flag is raised by a small hand winch. The cord passes around a drum of 100 mm diameter.



(e) Calculate the torque on the drum due to the tension on the rope of 9.3 N.

2
1
1
0

To stop the flag lowering under its own weight, the winch is fitted with the mechanism shown below.

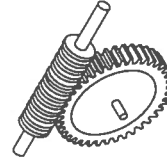


(f) State the name of parts (A) and (B).

(A) _____ (B) _____

2
1
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The sketch below shows another type of mechanism that stops the output from driving the input.

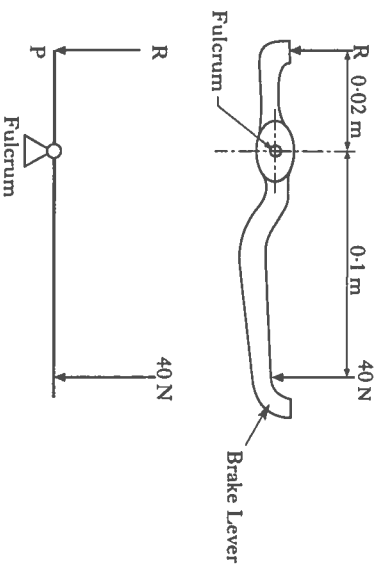


(g) State the name of the mechanism shown above.

_____ and _____

2
1
0

4 Detail of a brake lever for hydraulic brakes on a mountain bike is shown below.



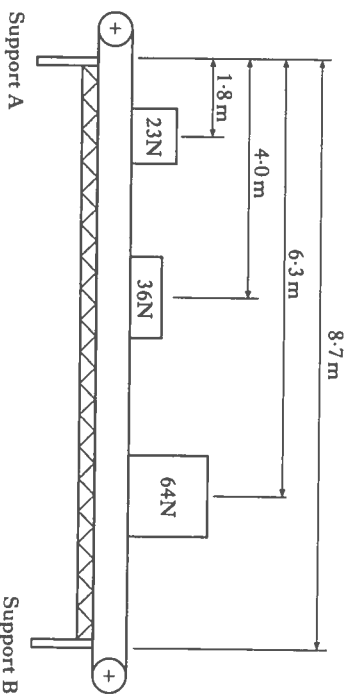
Calculate, by taking moments about the Fulcrum, the force R from the hydraulic brake piston.

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3	2
2	1
1	0

3
2
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7 A conveyor belt is used to move packages in a warehouse. When the conveyor belt stopped, packages were in the position shown.



(a) Draw the free body diagram for the system.

(b) (i) Calculate, by taking moments about support A, the reaction at support B.

(ii) Determine the reaction at support A.

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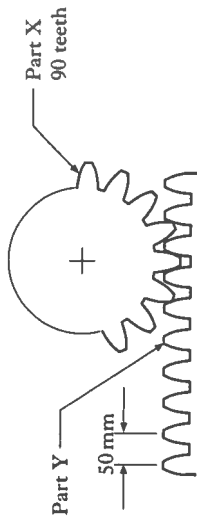
2
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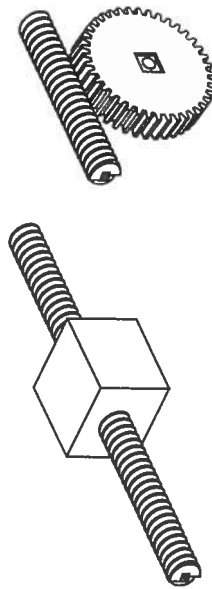
2
1
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6 (continued)

- (c) Calculate the linear speed of the train along the track. The pitch of Part Y is 50 mm.



- (d) State the names of the mechanisms shown below.



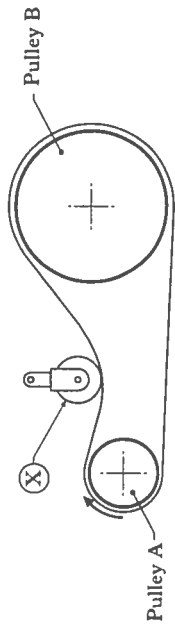
- (i) Worm and _____
 (ii) Worm and _____
 (iii) State an advantage in the use of a worm in a lifting system.

2
1
0

[Turn over

2
1
0

- 5 An air compressor on a heavy goods vehicle is driven by a belt.



- (a) State the name of device (X) in the sketch above.

1
0

Pulleys can rotate either **clockwise** or **anti-clockwise**.

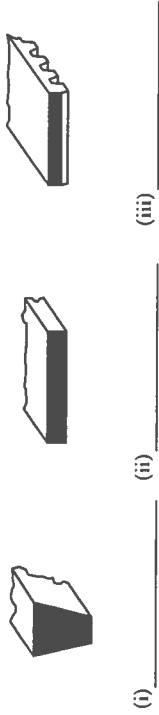
Pulley A rotates clockwise, as shown in the diagram above.

- (b) State the direction of rotation of device (X).

1
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Three different types of belts are shown below.

- (c) State the name of each belt.



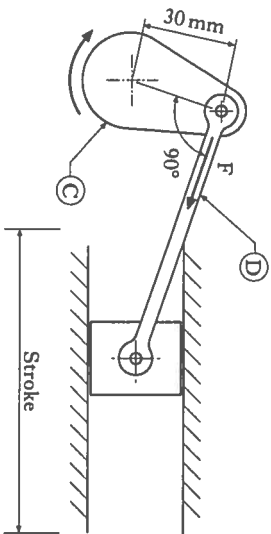
Friction is the resistance of one surface to move over another.

- (d) State **two** methods of **reducing** friction.

2
1
0

5 (continued)

The mechanism shown below is used in the compressor.



- (e) State the names of parts C and D.
 C _____ D _____
- (f) Determine the length of stroke for the above mechanism.

Part C has a radius of 30 mm and, as it rotates, the force F in part D is 250 N in the position shown.

- (g) Calculate the torque.

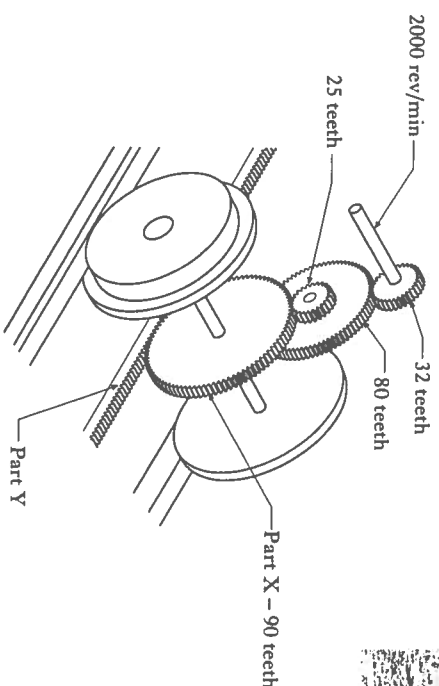
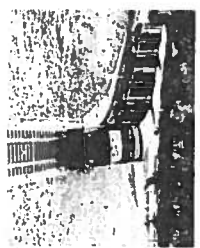
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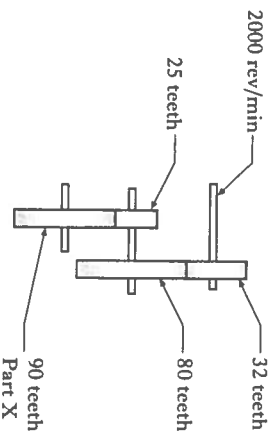
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	1	0	
	2	1	
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Turn over

- 6 A model train climbs a steep slope at an amusement park. A simplified diagram of the train drive system is shown here.



- (a) State the names of the labelled parts of the drive system in the diagram above.
 Part X _____
 Part Y _____
- (b) A simplified diagram of the train drive system is shown. Calculate the speed of the 90 tooth gear.
 _____ rev/min



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	2	1	
	1	0	
	4	3	
	2	1	
	1	1	
	0	0	