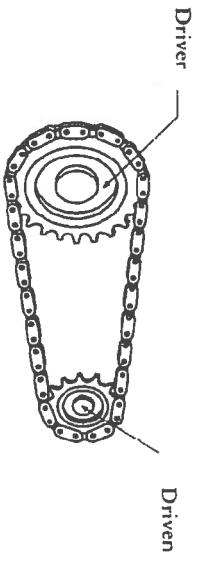# Engineering Science

## Mechanisms & Structures

### Class Test

National 5 - KU    - 12
         RNA    - 19

National 4 - KU    - 2
         RNA    - 13

2. Most bicycles use the drive mechanism shown below.

Driver

Driver

Driven

(a) State the **full** name of the mechanism shown.                    KU -2

_____ and _____

One particular bike can have 10 different "speeds". The number of "teeth" available on the Driver and Driven are given in the table below.

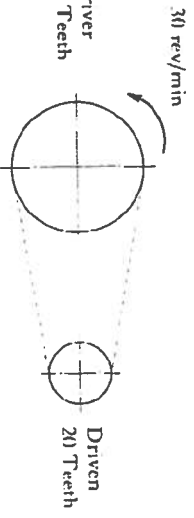| Driver | Driven |
|--------|--------|
| 52     | 29     |
| 42     | 24     |
|        | 20     |
|        | 17     |
|        | 15     |

(b) State which combination of Driver and Driven would provide the fastest speed.    RNA - 2

_____ and _____

(c) For the arrangement shown below, calculate the speed of the Driven if the Driver is rotating at 30 rev/min. **(Show all working and units.)**    RNA - 3

30 rev/min

Driver
42 Teeth

Driven
20 Teeth

4. A roller shutter is raised and lowered manually using a chain and sprocket system.



Roller Shutter

200N

0·3m
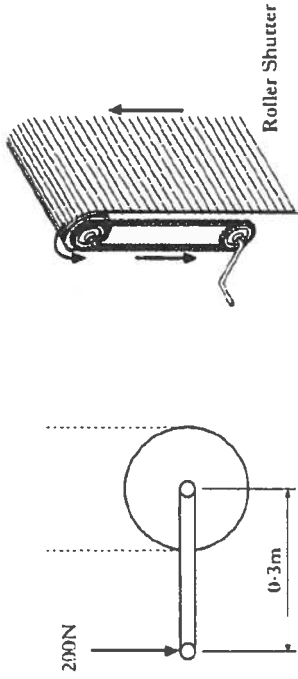
The line diagram above shows detail of the handle and the bottom sprocket.

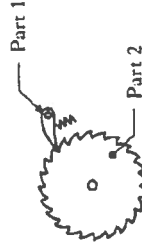(a) Calculate, showing all working and units, the input torque.

(b) State a method of increasing the torque without increasing the input force.

_____

When the handle is released, the shutter drops down due to its own weight.

The diagram below shows a mechanism which could be added to prevent this.



Part 1

Part 2

(c) (i) State the correct name of each part.

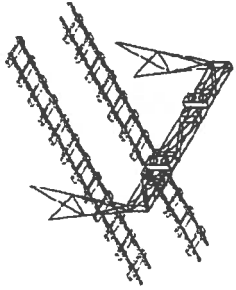Part 1 _____

Part 2 _____

(ii) State the direction in which part 2 is free to rotate.

_____

5. A gantry used to support two railway signals is positioned above the tracks as shown.



Each of the signal heads weighs 3 kN and is positioned on the gantry as shown. The gantry itself weighs 35 kN, which acts through its centre of gravity. Calculate the reactions of R1 and R2. (Show all working and units.)
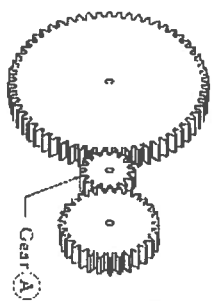


R1

2 m  3 kN
Signal head

4.25 m  35 kN

5.5 m  Signal head  3 kN

8.5 m  R2
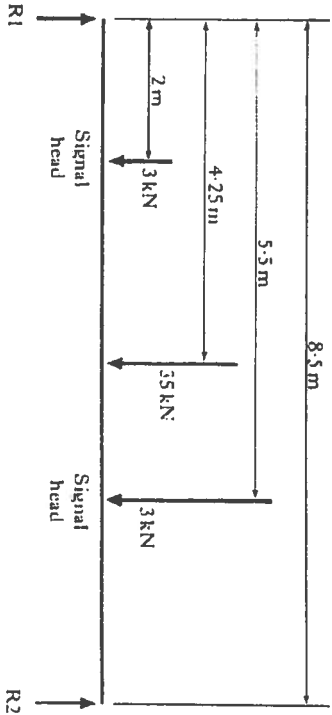
(a) Take moments about R1 to calculate R2.
(Show all working and units.)

(b) Take moments about R2 to calculate R1.
(Show all working and units.)

---

6. (continued)

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



Gear A

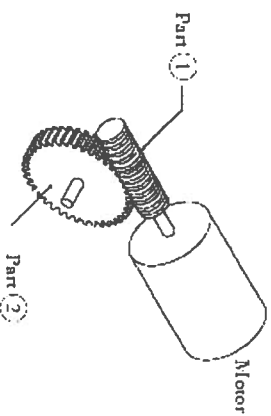(c) State one advantage of using a gear drive over a belt drive.  KU - 1

(d) (i) State the name of Gear A.  KU - 1

(ii) Describe the effect Gear A has on the output speed and direction of the mechanism.  KU - 2

Another part of the system makes use of the mechanism shown below.  KU - 2



Part 1

Part 2

Motor

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

Part 1:

Part 2:

KU - 2