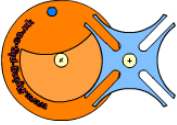
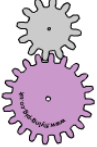


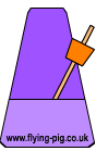

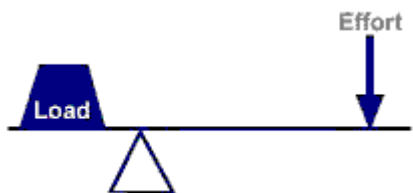
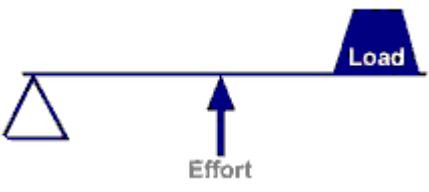

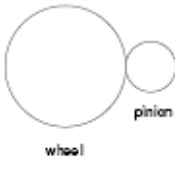
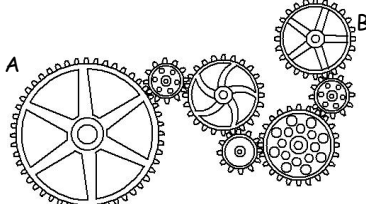
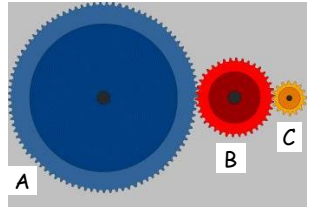

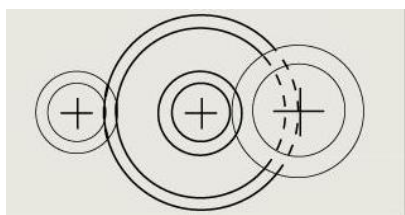
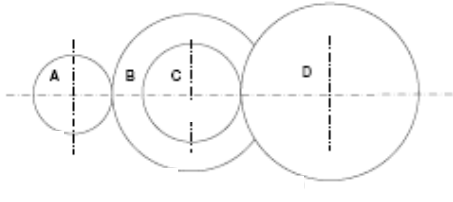


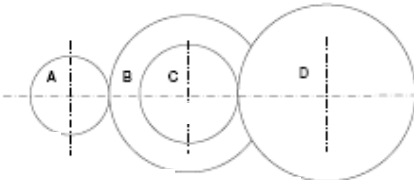
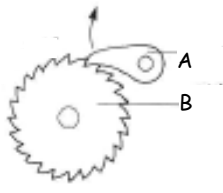



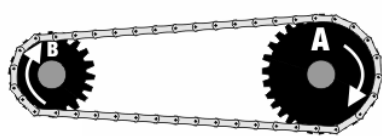
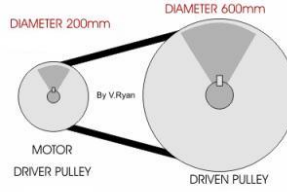
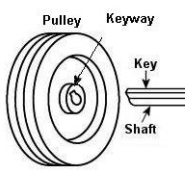
Types of Motion		Go to http://www.robives.com and fill in the boxes below.
	Name of Motion - Intermittent Example of use – Cinema projector	
	Name of Motion - Rotary Example of use - Gearbox	
	Name of Motion - Linear Example of use – Vehicle on a road	
	Name of Motion - Irregular Example of use – Movement in an automata	
	Name of Motion - Oscillating Example of use – Metronome or Clock pendulum	
	Name of Motion - Reciprocating Example of use – Piston in a car engine	

Levers	
	<p>What order (class) of lever is this? – 1st</p> <p>What is another name for the pivot? - Fulcrum</p> <p>Give an example of this type of lever. - Crowbar</p>

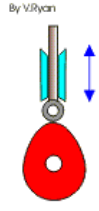
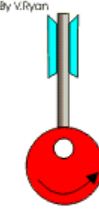
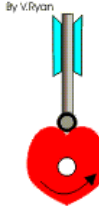
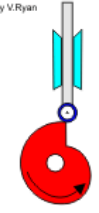
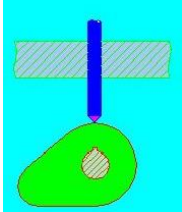
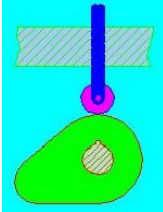
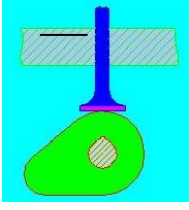
	<p>What order (class) of lever is this? – 3rd</p> <p>Is this system efficient? - No</p> <p>Give an example of this type of lever. - Tweezers</p>
	<p>What order (class) of lever is this? – 2nd</p> <p>Is this system efficient? - Yes</p> <p>Give an example of this type of lever. - Wheelbarrow</p>

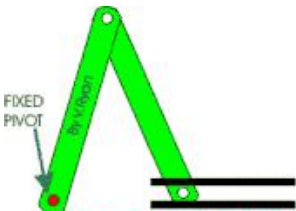
Gears Note: In this section 100T means 100 Teeth on the gear wheel

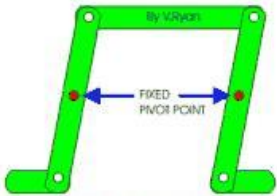
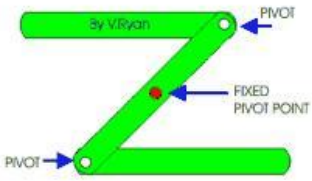
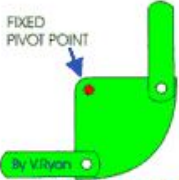
	<p>What type of gear train is this? - Simple</p> <p>If the wheel has 50T and the pinion 10T, what is the gear ratio of this system? – 5:1</p> <p>If the wheel is rotating at 100rpm. What is the rotational velocity of the pinion? – 500rpm</p>
	<p>If A is turning clockwise, which direction is B turning? - Clockwise</p>
	<p>If A has 100T, B has 40T and C 10T what is the gear ratio of the system? – 10:1</p> <p>If A is turning anticlockwise, what is the direction of C. - Anticlockwise</p> <p>What is the effect of increasing the number of teeth on B to 50T. – No effect</p>
	<p>What is the name of this gear system? - Planetary</p>
	<p>What is the name of this type of gear train? - Compound</p> <p>What is the advantage of using one? – Get larger gear ratios without using large gears</p>
	<p>A has 10T, B has 30T, C has 15T and D has 60T.</p> <p>What is the gear ratio of the system? – 12:1</p> <p>If A is turning at 120 rpm, what is the rotational velocity of D? – 10 rpm</p> <p>If D is turning at 100 rpm, what is the rotational velocity of A? – 1200 rpm</p>

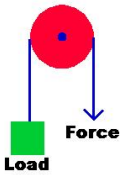

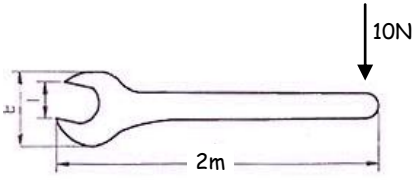
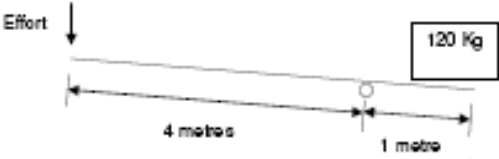
	<p>A has 20T, B has 30T, C has 30T and D has 90T. What is the gear ratio of the system? - 4.5:1 If A is turning at 450 rpm, what is the rotational velocity of D? – 100 rpm If D is turning at 50 rpm, what is the rotational velocity of A? – 225 rpm</p>
	<p>Name this system. – Ratchet and Pawl A is called the Pawl B is called the Ratchet (wheel) In which direction does B turn? - Anticlockwise Where might you find this system? - Clock</p>
	<p>Name this system. – Rack and Pinion A is called the Pinion B is called the Rack If A turns clockwise does B move to the right or the left? - Left Where might you find this system? – Drilling Machine</p>
	<p>Name this type of gear. – Worm Gear If A has 20T what is the gear ratio of the system? – 20:1 If the motor is turning at 2000 rpm, what is the rotational velocity of A? – 100 rpm</p>
	<p>Name these gears. – Bevel gears What is their function? – Turn the motion 90° Give an example of where you might find them. – On a hand drill</p>
	<p>If A has 30T and B 15T, what is the gear ratio? - 2:1 If A turns 10 times, how many times does B turn? – 20 times Give an advantage of a chain system. – Gears can be apart e.g on a bicycle</p>
	<p>These 2 pulleys have diameters of 200mm and 600mm. What is the velocity ratio of the system? - 3:1 If the motor is turning at 3000 rpm, how fast is the driven pulley turning? – 1000 rpm</p>
	<p>Describe the purpose of a key and keyway on a pulley. – So the pulley does not slip on the axle: ie they rotate together</p>

<p>Cams</p>
<p>A cam system converts ROTARY motion into LINEAR motion.</p>

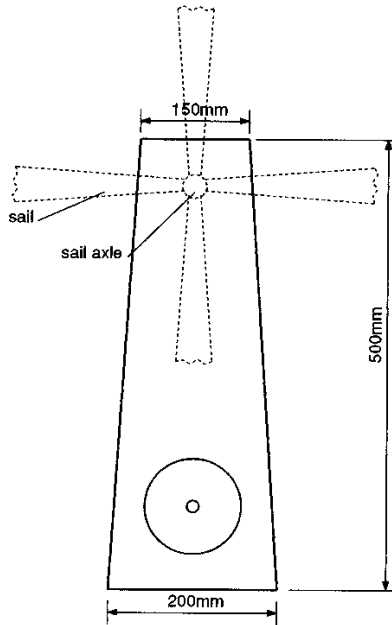
	<p>Name this shape of cam. – Pear Describe the output motion. - The follower does not move (dwell) for half the revolution and then moves up and down.</p>
	<p>Name this shape of cam. - Circular Describe the output motion. – The follower moves up and down in a simple harmonic motion</p>
	<p>Name this shape of cam. - Heart Describe the output motion. – The follower moves up and down at a constant speed</p>
	<p>Name this shape of cam. - Drop Describe the output motion. – The cam can only turn anticlockwise and creates a sudden dropping motion</p>
	<p>The part that touches the cam is called a FOLLOWER Name this type. - Knife</p>
	<p>Name this type. - Roller</p>
	<p>Name this type. - Flat</p>

<p>Linkages</p>	
	<p>Name this type of linkage. – Crank and Slider</p>

	<p>Name this type of linkage. – Parallel Motion</p>
	<p>Name this type of linkage. _____</p>
	<p>Name this type of linkage. - Bell Crank</p>

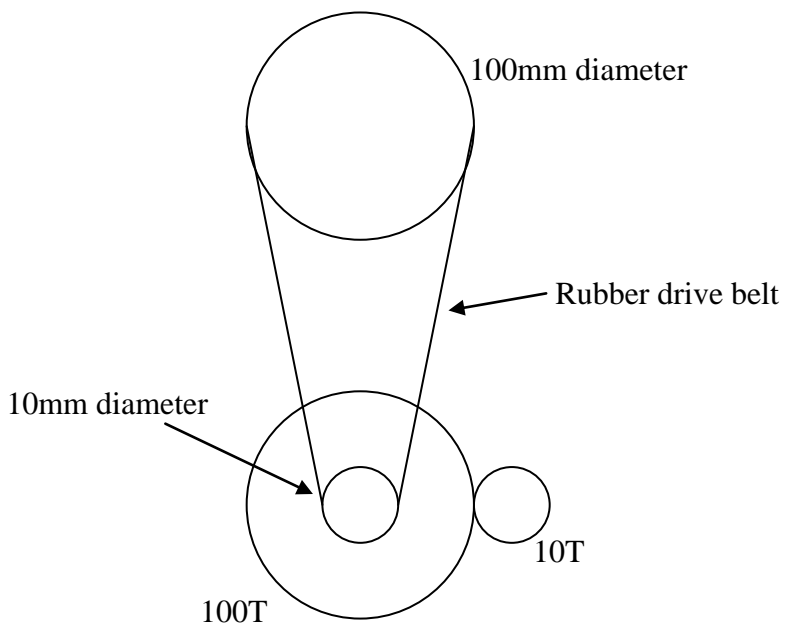
<p>Pulleys</p>	
	<p>What effort would be required to lift a load of 10N? – 10N</p> <p>What is the efficiency of this system? 1 (100%)</p>
	<p>What effort would be required to lift a load of 100N? – 25N</p> <p>What is the efficiency of this system? 4 (400%)</p>
	<p>What force in Nm is exerted in this system? – 20Nm</p>
	<p>What effort is required to lift the load of 120kg? - 30Kg</p>

1. An outline view of a model windmill which is to be driven by an electric motor is shown below. The motor turns at 1000 revs/min, and the windmill vanes are required to turn at 10 revs/min.



- (a) Choose components from the list below and draw, in the space opposite, a diagram to show how the motor could drive the sails. [10]

Component	Notes
Nylon pulley	10 mm diameter (2 mm hole) and 100 mm diameter (4 mm hole) available;
Brass gear	10 mm diameter/10 teeth (2mm hole) and 100 mm diameter/100 teeth (2mm hole) available;
Ramin dowel	4 mm and 6 mm diameter in 300 mm and 600 mm lengths available;
Mild steel rod	2 mm and 4 mm diameter in 300 mm and 600 mm lengths available;
Rubber drive belt	300 mm and 650 mm loops available.



(b) The choice of components for the windmill includes gears and pulleys, as both could be used for this type of system.

Name another application where a pulley and belt system would be **more** suitable than a gear system, and give **one** reason why this is the case. [3]

Application **Alternator – Water Pump – Engine drive in a car**

Reason **Allows 2 items to be driven from the engine**

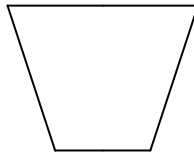
.....
.....

(c) Give **one** reason why rubber is a suitable material for drive belts in many systems. [1]

..... **Flexible – long lasting**

(d) Some systems use drive belts with a 'v' cross section.

(i) In the space below, draw the cross-section of a 'v' belt. [2]



(ii) Name **one** system which may use a 'v' belt and explain why a 'v' belt is suitable for this system. [2]

System **On a drilling machine**

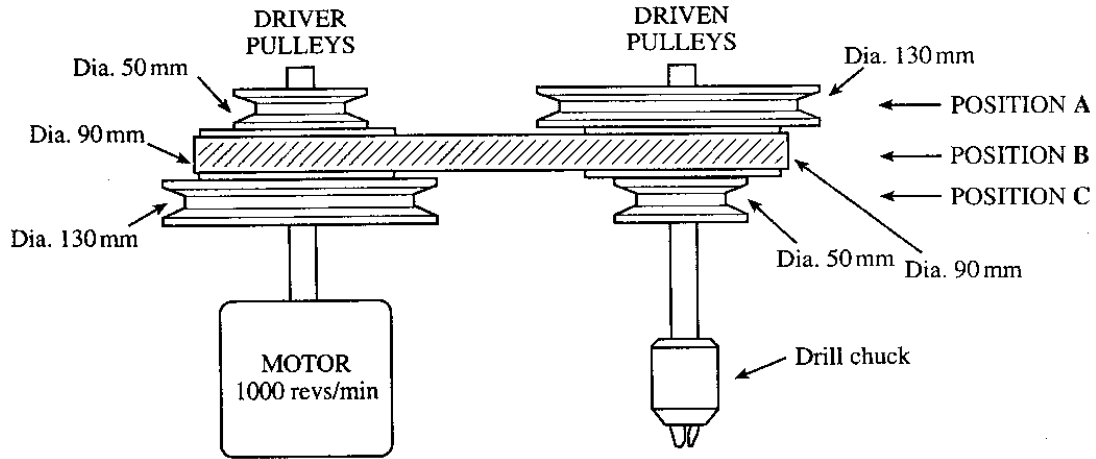
Reason **Cannot jump out of the grooves easily**

.....
.....

(iii) Drive belts should always have a guard fitted over them.

In the space below, draw a circuit to show how the power to a motor could be switched off if a guard is moved. [2]

4. (a) The pulley and belt system used on a drilling machine is shown below.



(i) With the belt set in position **B** (as shown) what is the rotational velocity (RV) of the drill chuck? [1]

RV = 1000

(ii) Using the letter **A**, **B** or **C** complete the sentence below. [1]

In order to get the fastest drill chuck rotation the belt must be placed in

position **C**

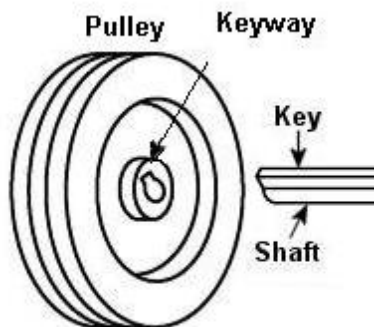
(iii) Calculate the rotational velocity of the drill chuck if the belt is placed in position **C**. (Show all workings out). [3]

$130 \div 50 = 2.6:1$

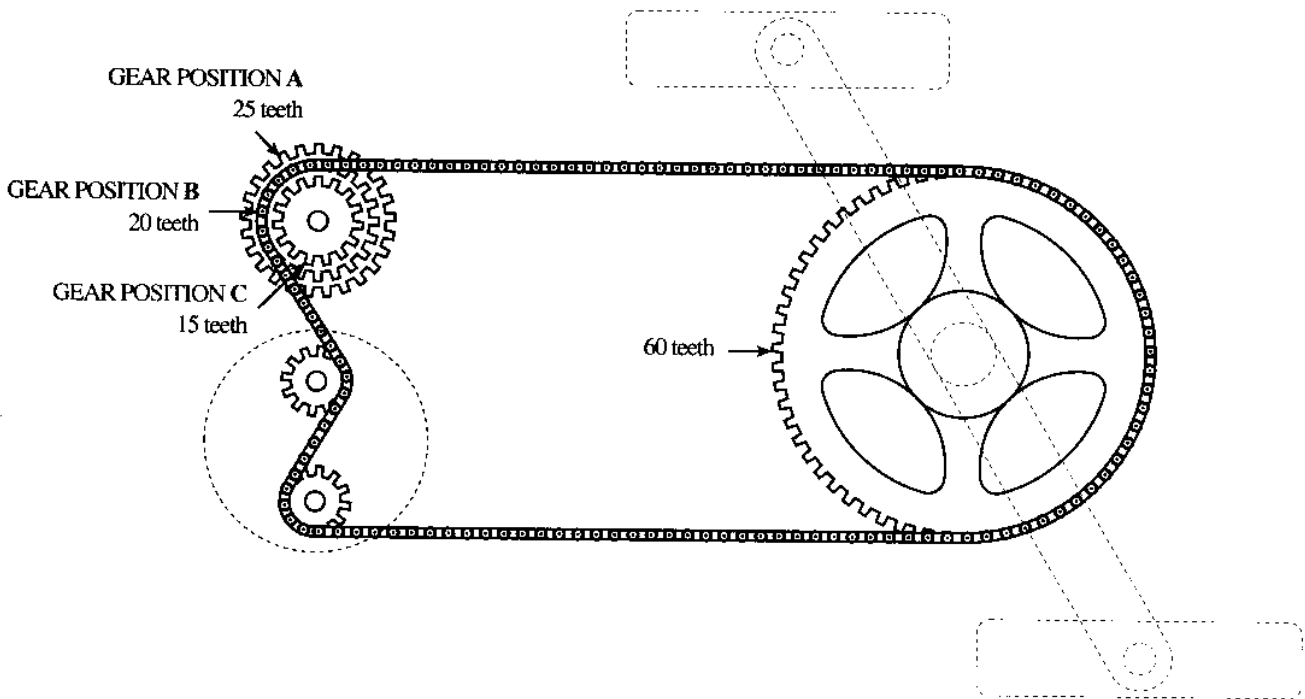
$2.6 \times 1000 = 2600 \text{ rpm}$

(iv) What type of belt is used on this drilling machine? **V belt** [1]

(v) In order to transmit motion properly the driver pulley needs to be securely fixed to the motor shaft. In the space below sketch a method of doing this. [2]



(b) A simple chain and sprocket gear system used in a bicycle is shown below.



- (i) State which gear position (A, B or C) is best for going up hill. **A** [1]
- (ii) State which gear position (A, B or C) will drive the bicycle the fastest. **C** [1]
- (iii) With the chain set in gear position B (as shown) and the rider pedalling at 30 revs/min calculate the RV (rotational velocity) in revs/min of the rear wheel. Show all calculations. [3]

60 : 20

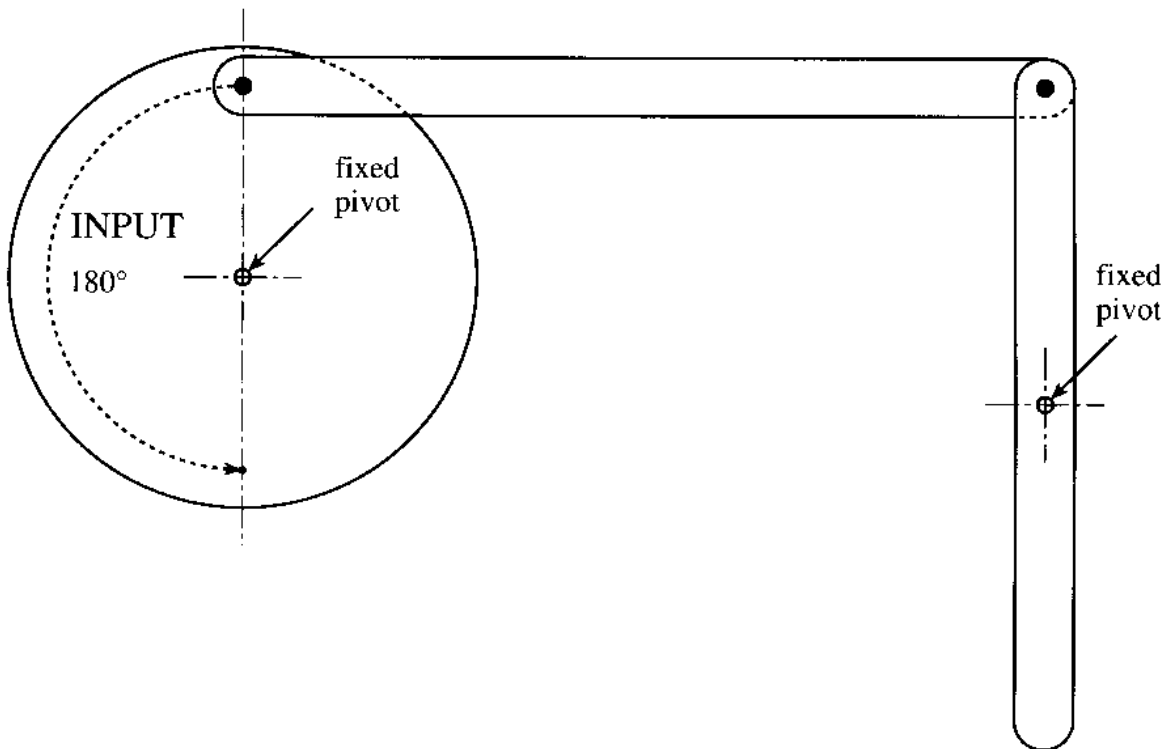
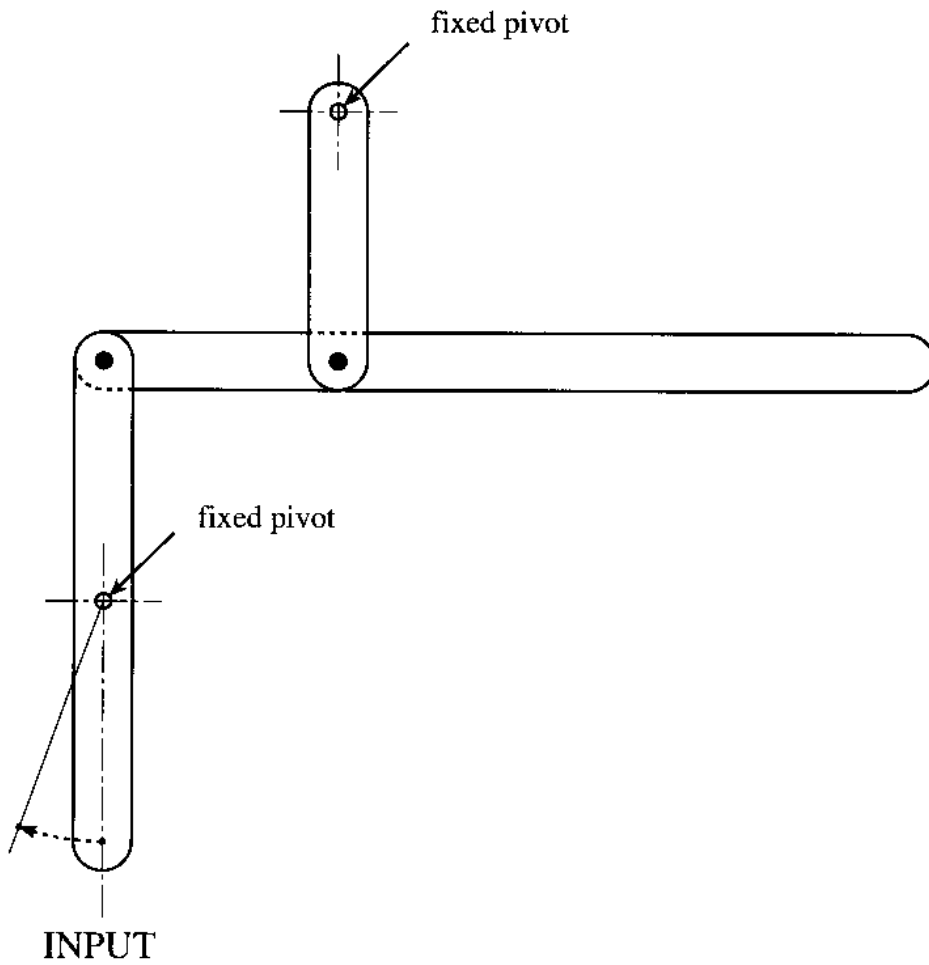
3 : 1

30 x 3 = 90 rpm

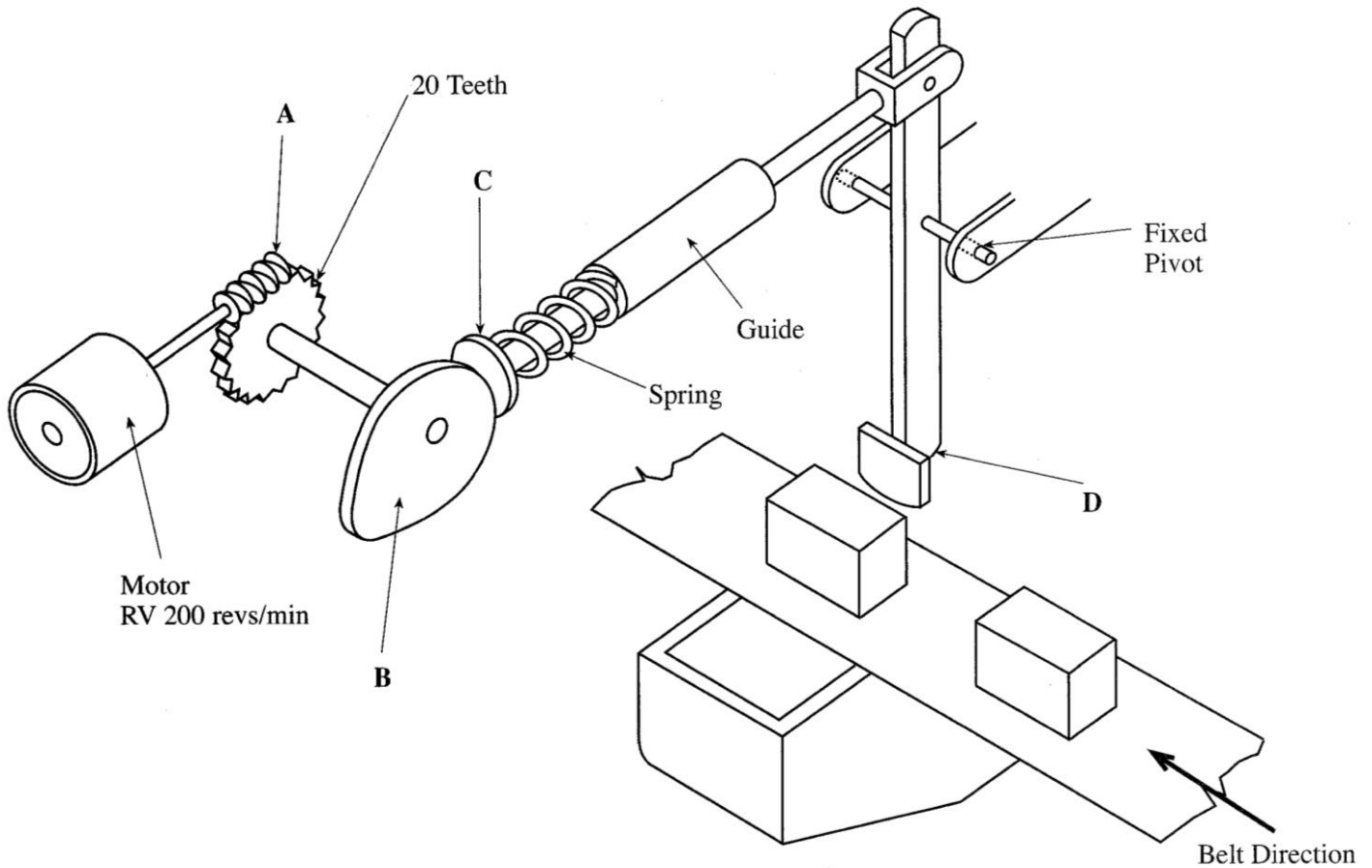
- (iv) Explain one important function of the part of the system circled. [2]

Maintains tension in the chain to stop it going slack and coming off

- (a) Two linkage systems are drawn below. The direction and distance of an input motion is given for each system. The paths of some points are also shown. **Draw** the position of **each** system after the input has been applied. [4]



4. A mechanism which pushes items off a conveyor belt into a box is shown below. Study the mechanism and answer the questions.



(a) Complete these sentences by adding the name of the component. [3]

- (i) Component A is a Worm.....
- (ii) Component B is a Cam.....
- (iii) Component C is a Follower.....

(b) Complete these sentences by stating what kind of motion each part has. Select the word from the list given. [3]

LINEAR RECIPROCATING ROTARY OSCILLATING

- (i) Component A has Rotary..... motion.
- (ii) Component C has Linear..... motion.
- (iii) Component D has Oscillating..... motion.

- (c) The motor has a rotational velocity of 200 revs per minute. **Calculate** how many items are pushed off the conveyor belt in **one** minute. [2]

$$200 \div 20 = 10$$

.....
.....
.....

Number of items: 10

- (d) **Explain** the purpose of the spring. [2]

The follower stays in contact with the cam, when it moves backwards and forwards

.....
.....

- (e) **Explain one** change that could be made to the mechanism to make part **D** move a greater distance. [2]

Draw a simple diagram to help your explanation.

Make the cam larger

.....

Make the guide longer

.....

.....

.....

.....