	GCSE Systems and Control	Name :
LKC	Ref : Mechanisms	

Types of Motion   Go to http://www.robives.com/mechs and fill in the boxes below.

	Name of Motion _____ Example of use _____
	Name of Motion _____ Example of use _____
	Name of Motion _____ Example of use _____
	Name of Motion _____ Example of use _____
	Name of Motion _____ Example of use _____
	Name of Motion _____ Example of use _____

Levers

Effort Load	What order (class) of lever is this?_____ What is another name for the pivot?_____ Give an example of this type of lever._____

	What order (class) of lever is this?_____ Is this system efficient? _____ Give an example of this type of lever._____
	What order (class) of lever is this?_____ Is this system efficient? _____ Give an example of this type of lever._____

| Gears	Note: In this section 100T means 100 Teeth on the gear wheel
	What type of gear train is this? _____ If the wheel has 50T and the pinion 10T, what is the gear ratio of this system? _____ If the wheel is rotating at 100rpm. What is the rotational velocity of the pinion?_____
	If A is turning clockwise, which direction is B turning? _____
	If A has 100T, B has 40T and C 10T what is the gear ratio of the system?_____ If A is turning anticlockwise, what is the direction of C. _____ What is the effect of increasing the number of teeth on B to 50T. _____
	What is the name of this gear system? _____
	What is the name of this type of gear train?_____ What is the advantage of using one? _____
	A has 10T, B has 30T, C has 15T and D has 60T. What is the gear ratio of the system?_____ If A is turning at 120 rpm, what is the rotational velocity of D? _____ If D is turning at 100 rpm, what is the rotational velocity of A? _____
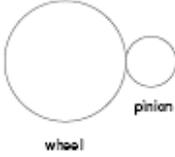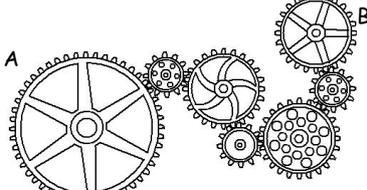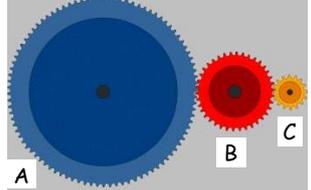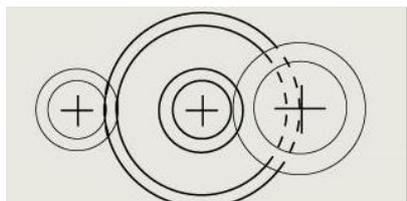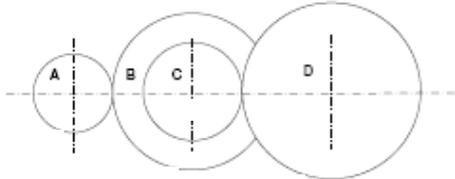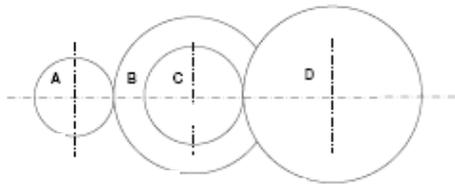
	A has 20T, B has 30T, C has 30T and D has 90T. What is the gear ratio of the system?_____ If A is turning at 450 rpm, what is the rotational velocity of D? _____ If D is turning at 50 rpm, what is the rotational velocity of A? _____
	Name this system. _____ A is called the _____ B is called the _____ In which direction does B turn? _____ Where might you find this system? _____
	Name this system. _____ A is called the _____ B is called the _____ If A turns clockwise does B move to the right or the left? _____ Where might you find this system? _____
	Name this type of gear. _____ If A has 20T what is the gear ratio of the system? _____ If the motor is turning at 2000 rpm, what is the rotational velocity of A? _____
	Name these gears. _____ What is their function? _____ Give an example of where you might find them. _____
	If A has 30T and B 15T, what is the gear ratio? _____ If A turns 10 times, how many times does B turn? _____ Give an advantage of a chain system. _____
	These 2 pulleys have diameters of 200mm and 600mm. What is the velocity ratio of the system? _____ If the motor is turning at 3000 rpm, how fast is the driven pulley turning? _____
	Describe the purpose of a key and keyway on a pulley. _____
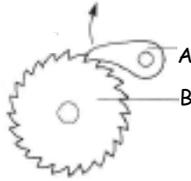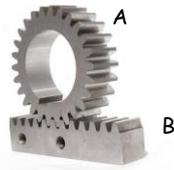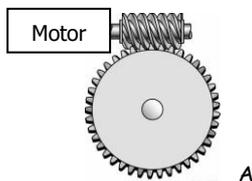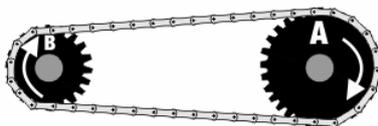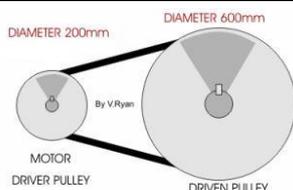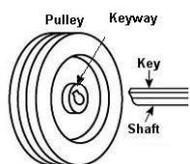
Cams	
A cam system converts _____ motion into _____ motion.	
By V.Ryan	Name this shape of cam. _____ Describe the output motion. _____
By V.Ryan	Name this shape of cam. _____ Describe the output motion. _____
By V.Ryan	Name this shape of cam. _____ Describe the output motion. _____
By V.Ryan	Name this shape of cam. _____ Describe the output motion. _____
	The part that touches the cam is called a _____ Name this type. _____
	Name this type. _____
	Name this type. _____
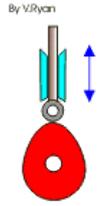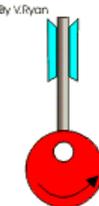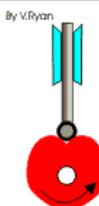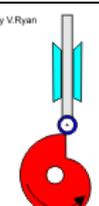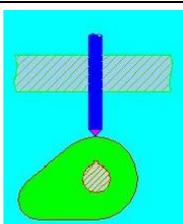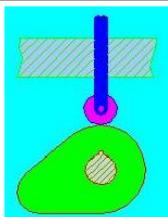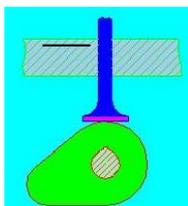
Linkages	
	Name this type of linkage. _____
	Name this type of linkage. _____
	Name this type of linkage. _____

Pulleys	
	What effort would be required to lift a load of 10N? _____ What is the efficiency of this system?_____
	What effort would be required to lift a load of 100N? _____ What is the efficiency of this system?_____
	What force in Nm is exerted in this system? _____
	What effort is required to lift the load of 120kg? _____
	Name this type of linkage. _____

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.

sail

sail axle

150mm

500mm

200mm
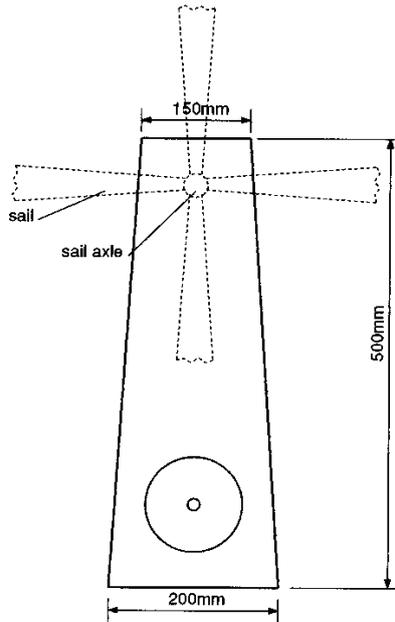
(a) Choose components from the list below and draw, in the space opposite, a diagram to show how the motor could drive the sails. [10]

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 ....

Reason ....

....

....

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

....

(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 ....

   Reason ....

   ....

   ....

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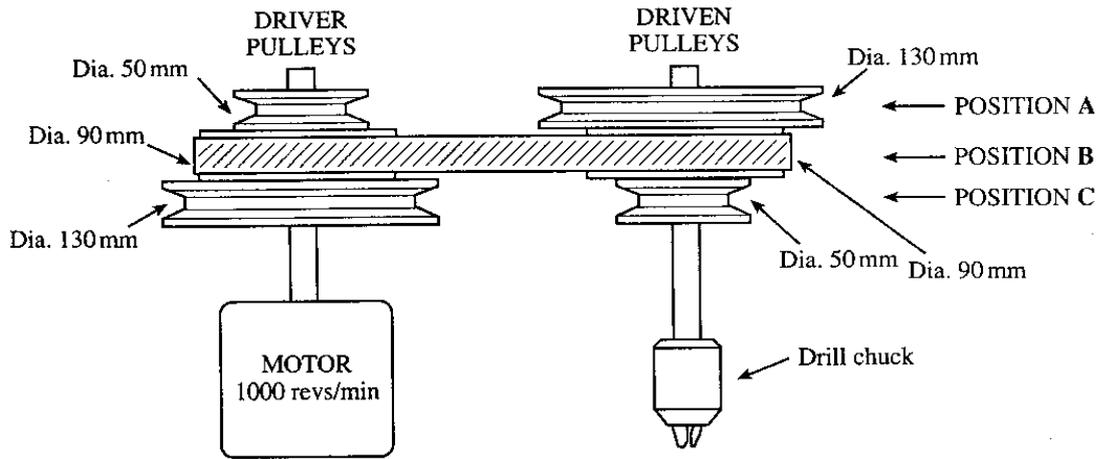
(i) With the belt set in position **B** (as shown) what is the rotational velocity (RV) of the drill chuck? [1]

RV = ...

(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 ....

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

....

....

....

....

....

(iv) What type of belt is used on this drilling machine? .... [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.

GEAR POSITION A
25 teeth

GEAR POSITION B
20 teeth

GEAR POSITION C
15 teeth

60 teeth
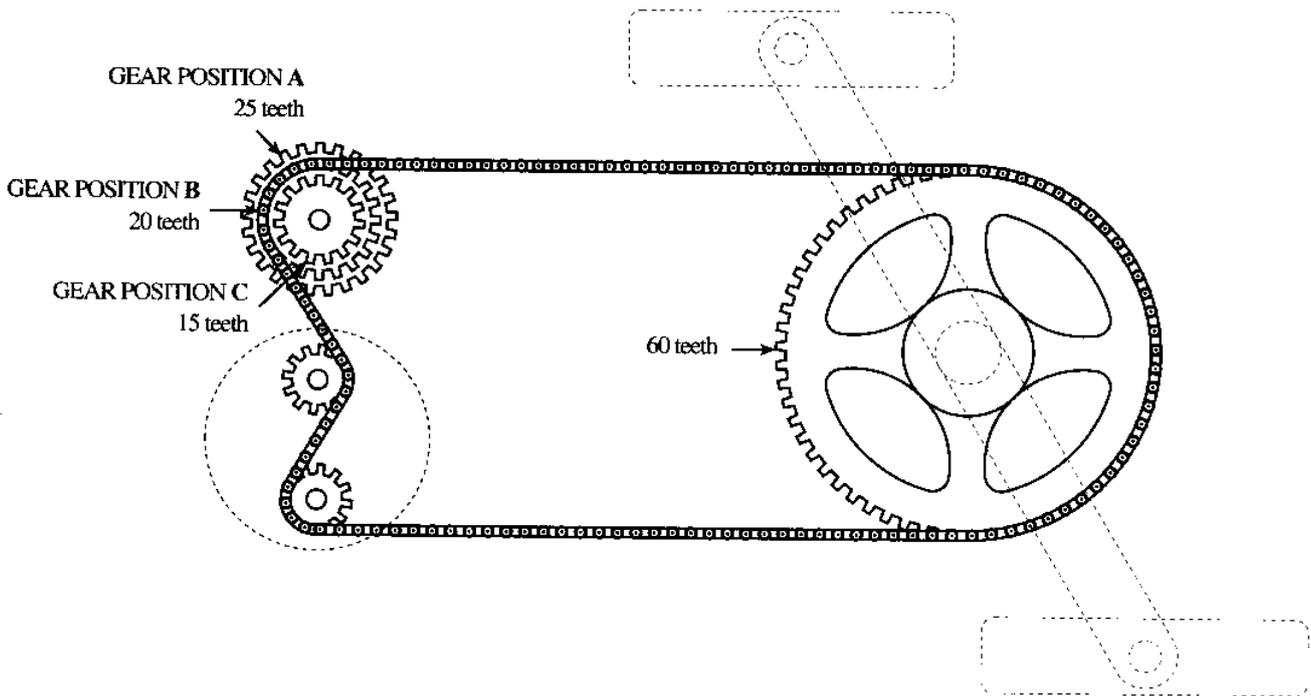
(i) **State** which gear position (**A**, **B** or **C**) is best for going up hill.   .... [1]

(ii) **State** which gear position (**A**, **B** or **C**) will drive the bicycle the fastest.   .... [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]

....

....

....

....

....

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

....

....

....

(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]

fixed pivot

fixed pivot

INPUT

INPUT

fixed
pivot

INPUT
180°

fixed
pivot

fixed
pivot
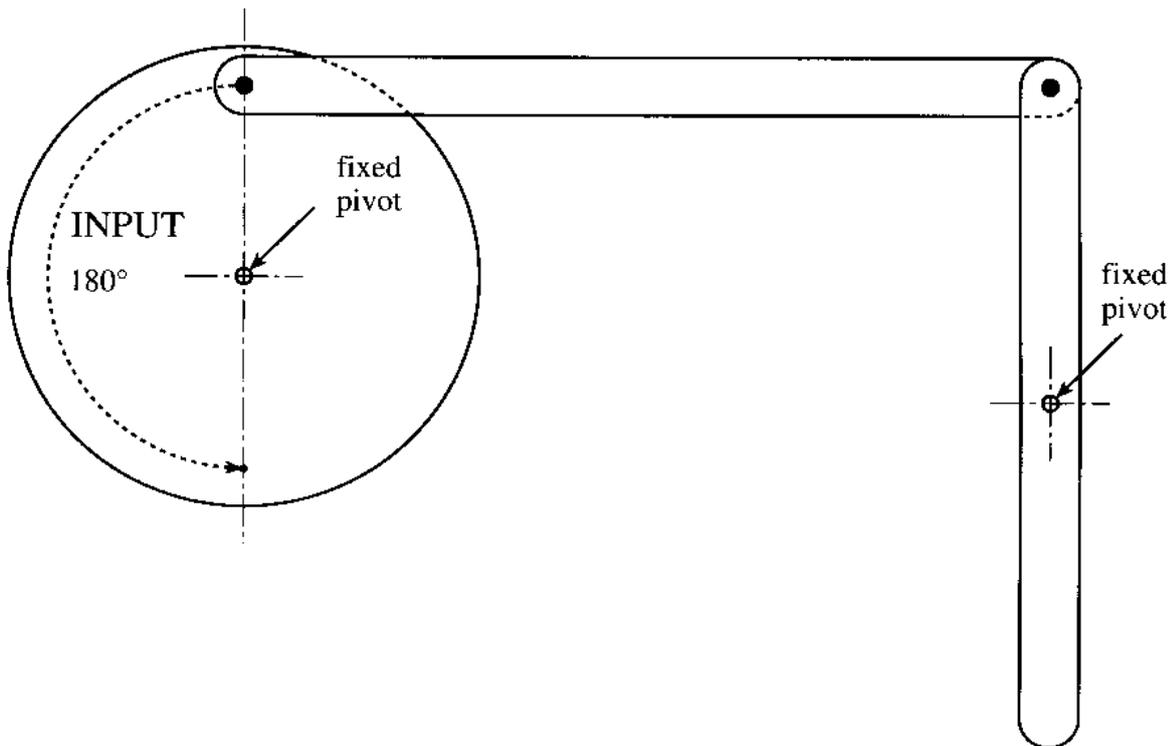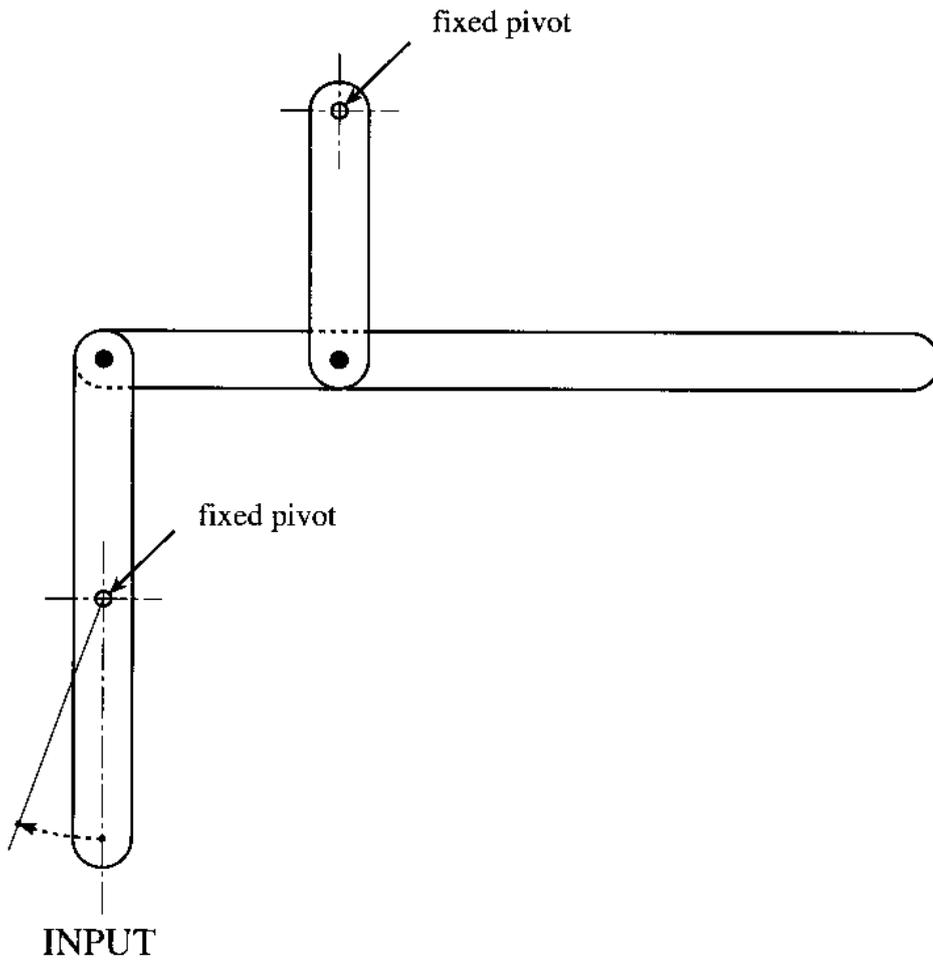
4. A mechanism which pushes items off a conveyor belt into a box is shown below. Study the mechanism and answer the questions.
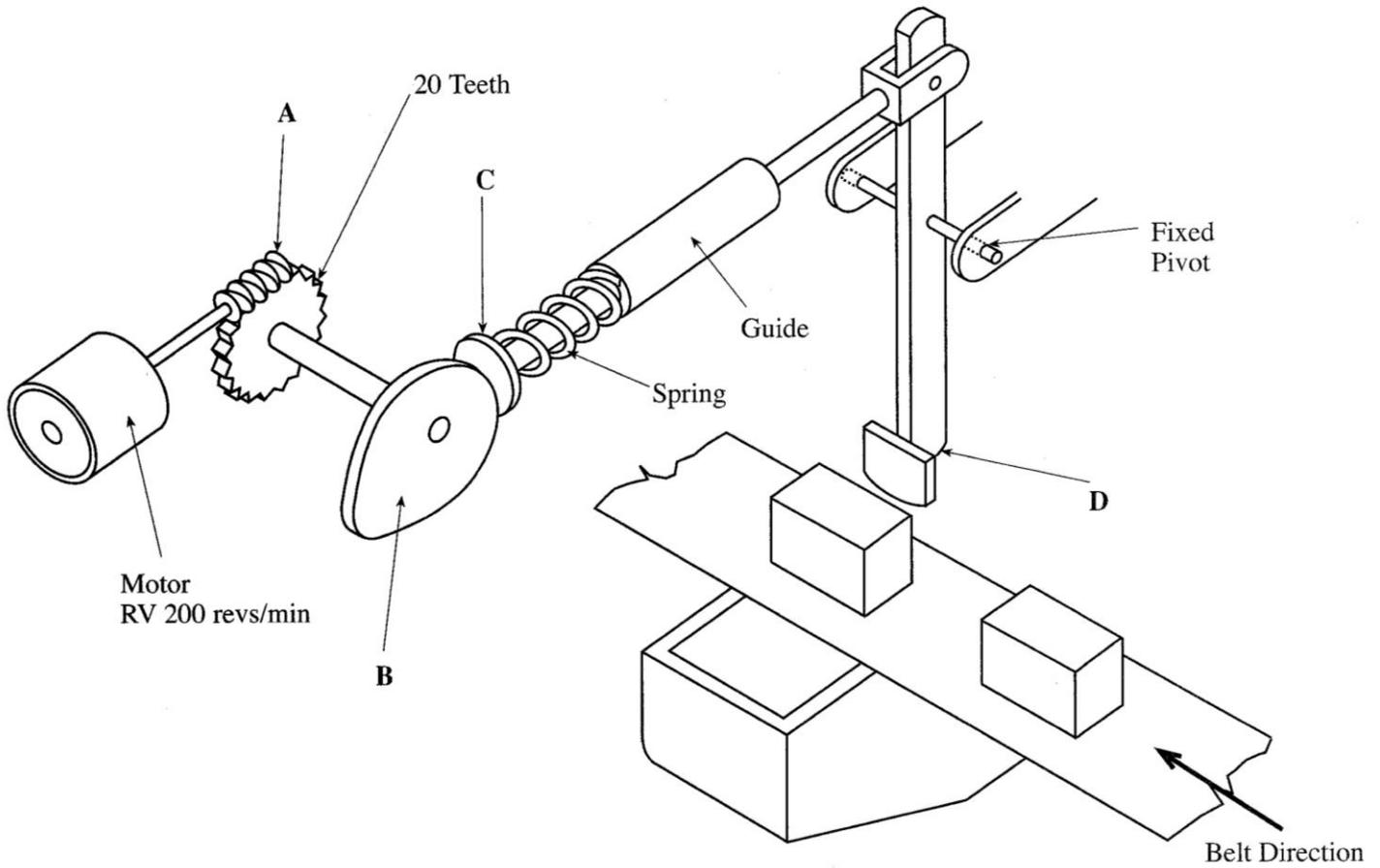
(a) **Complete** these sentences by adding the **name** of the component. [3]

   (i)   Component **A** is a ....

   (ii)   Component **B** is a ....

   (iii) Component **C** is a ....

(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 .... motion.

   (ii)   Component **C** has .... motion.

   (iii) Component **D** has .... 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]

....

....

....

Number of items: ....

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

....

....

(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.

....

....

....

....

....