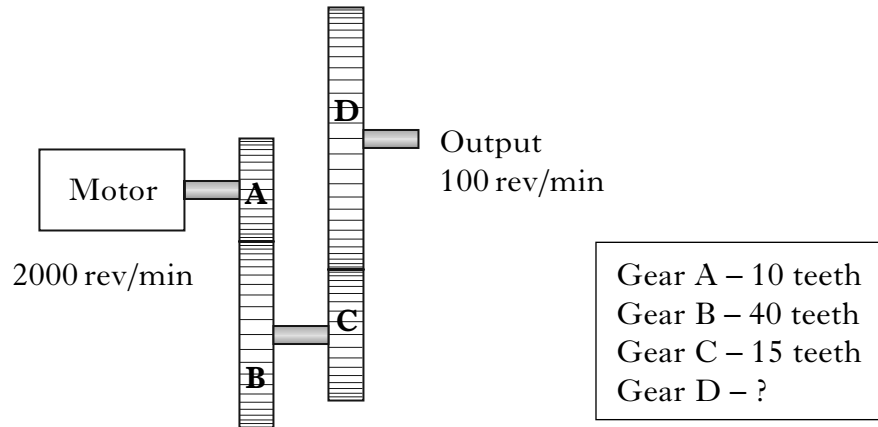


11. (continued)

Marks

A motor is used to raise the carriage to position A using the drive mechanism shown in Figure Q11(c).



(d) If the output speed is 100 rev/min, calculate:

(i) the velocity ratio for the drive mechanism;

2

(ii) the number of teeth on gear D.

3

(e) Gear D is replaced with a smaller gear with fewer teeth. Describe how this gear affects:

(i) the output speed;

1

(ii) the output torque.

1

(20)

[END OF QUESTION PAPER]

Marks

8. The drive mechanism used on a bicycle is shown in Figure Q8.

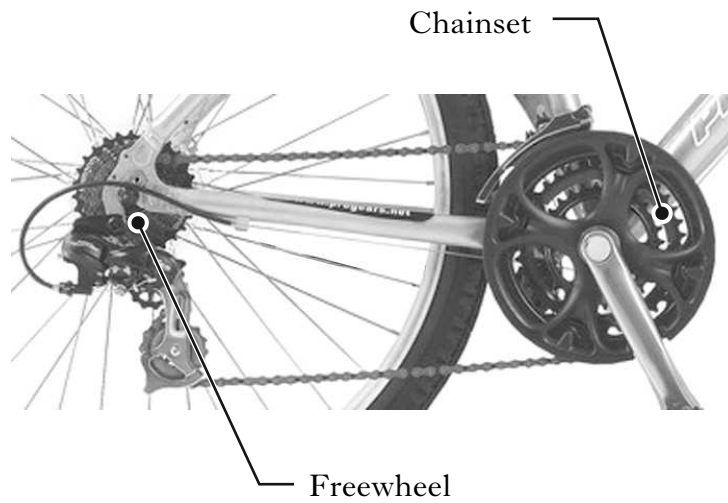


Figure Q8

(a) (i) State the name of the drive mechanism used on the bicycle.

1

(ii) State a general **disadvantage** of using this type of mechanism compared with a belt drive.

1

The bicycle shown in Figure Q8 has a 21 speed gearing system which can be made up from the gears in the table below.

Freewheel	Chainset
12 teeth	24 teeth
16 teeth	36 teeth
20 teeth	48 teeth
24 teeth	
28 teeth	
32 teeth	
36 teeth	

(b) Select, from the table, the freewheel and chainset that will produce the largest velocity ratio.

Freewheel _____ Chainset _____

1

Marks

11. A motorised system used to raise and lower a lighting gantry is shown in Figure Q11(a).

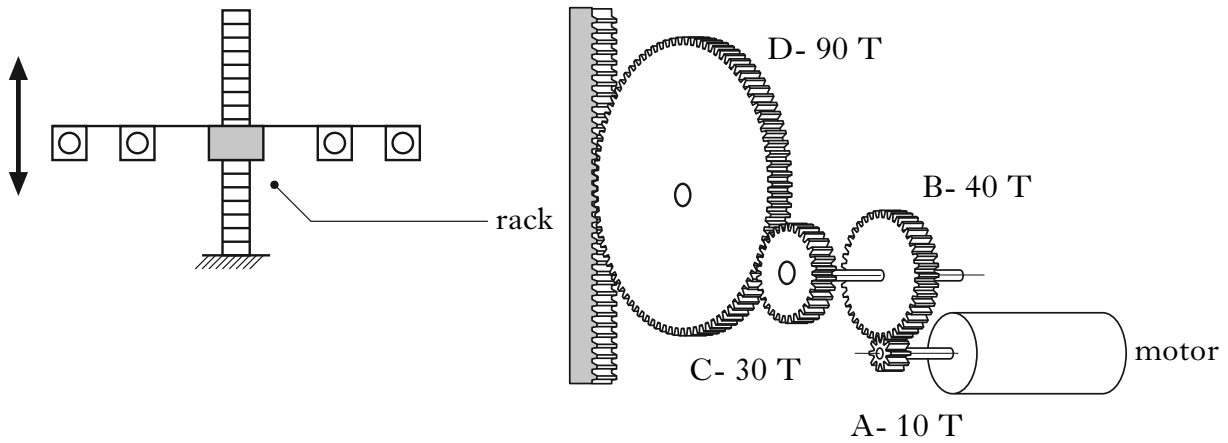


Figure Q11(a)

(a) Calculate, **showing all working and units:**

- (i) the rotational speed of gear D, if the motor shaft rotates at 1000 rev/min;

4

- (ii) the linear speed, in m/s, at which the lighting gantry will raise. The rack has 100 teeth per metre.

3

(b) State the name of a suitable mechanism that could be used to stop gear D slipping down the rack.

1

Marks

11. (continued)

When fully loaded the lighting gantry has a mass of 400 kg.

(c) Calculate, **showing all working and units:**

(i) the work done raising the lighting gantry by 20 m;

3

(ii) the electrical energy supplied to the motor if the system is 85% efficient;

2

(iii) the power consumption of the motor in 50 seconds.

2

(d) State one method of reducing energy loss while raising and lowering the lighting gantry.

1

[Turn over

9. (continued)

Marks

In this arrangement the motor can rotate in one direction only.

- (d) State the name of the type of relay that would allow the motor to rotate in **both** directions.

1

Figure Q9(c) shows the gear system used to control the output speed of the hand towels from the dispenser.

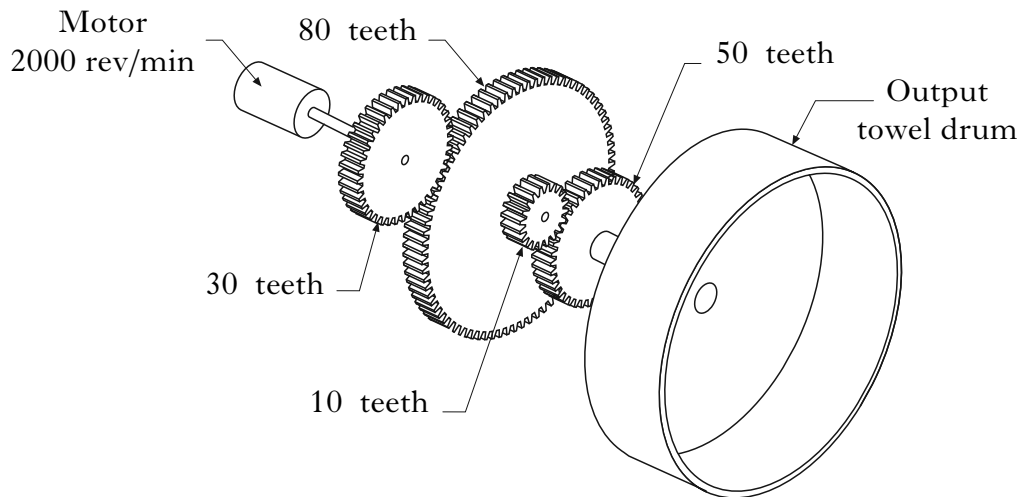


Figure Q9(c)

- (e) State the name of the gear system shown in Figure Q9(c).

1

- (f) State the direction of rotation of the output if the motor turns in a clockwise direction.

1

The motor rotates at 2000 rev/min.

- (g) Calculate, for the gear values given in Figure Q9(c), the output speed.

4

Marks

9. (continued)

The output torque from the gear arrangement was found to be too low to dispense the towels.

(h) (i) State what is meant by the term **torque**.

1

(ii) State a method of increasing the output torque of the gear system.

1

(20)

[Turn over

Marks

8. A gear system for operating a theatre curtain is shown in Figure Q8.

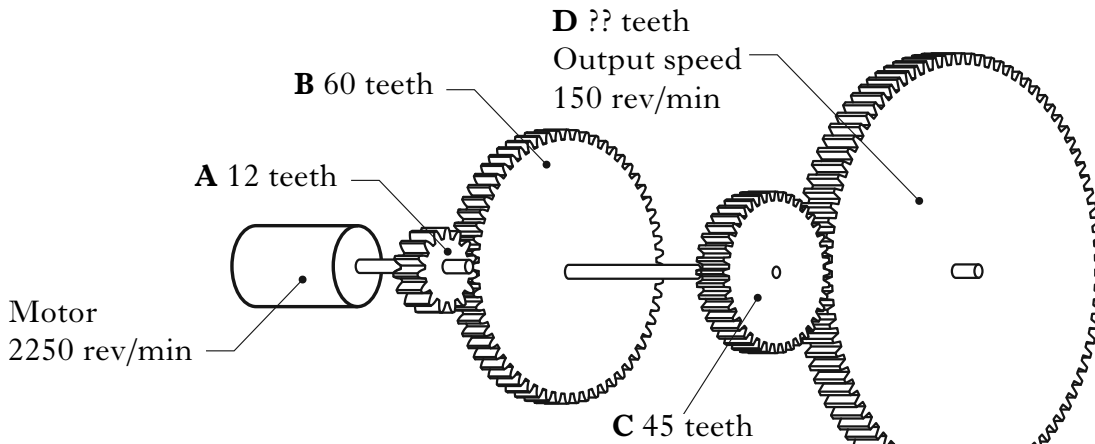


Figure Q8

(a) State the name of the type of gear system shown in Figure Q8.

1

(b) Calculate:

(i) the velocity ratio of the system when gear D rotates at 150 rev/min.

1

(ii) the ratio of gear B to gear A;

1

(iii) the number of teeth on gear D to produce the correct output speed.

2

(c) State **one** advantage of a gear system made from plastic rather than steel gears.

1

(6)

Marks

7. The drive system used in an airport luggage conveyor is shown in Figure Q7(a).

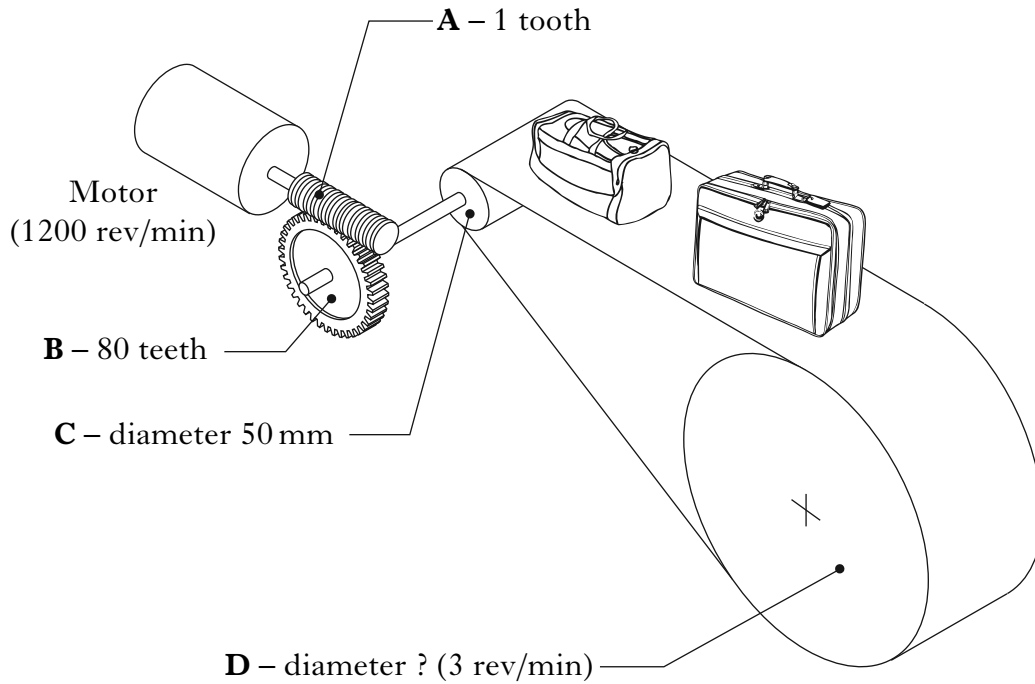


Figure Q7(a)

(a) State the name of gear **A**.

_____ 1

(b) Calculate, showing all working and units:

(i) the velocity ratio of the drive system;

2

(ii) the diameter of pulley **D**.

3

Marks

7. (continued)

The gearing is to be replaced with a belt drive.

The three belts shown in Figure Q7(b) were considered.

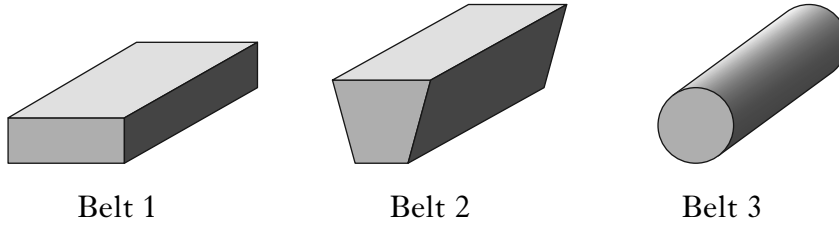


Figure Q7(b)

- (c) (i) State, with reference to Figure Q7(b), which belt would be used to reduce the amount of slippage in the drive system.

1

- (ii) Explain why the belt you have chosen reduces slippage.

1

(8)

[Turn over