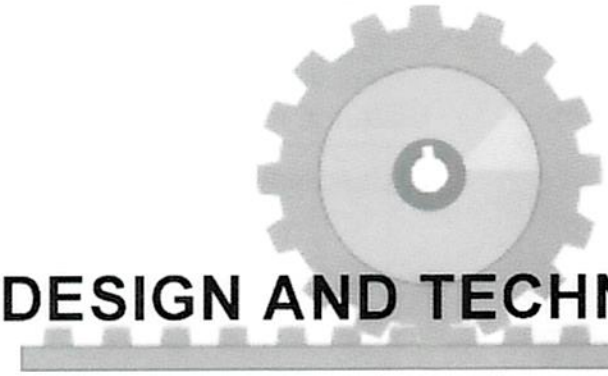
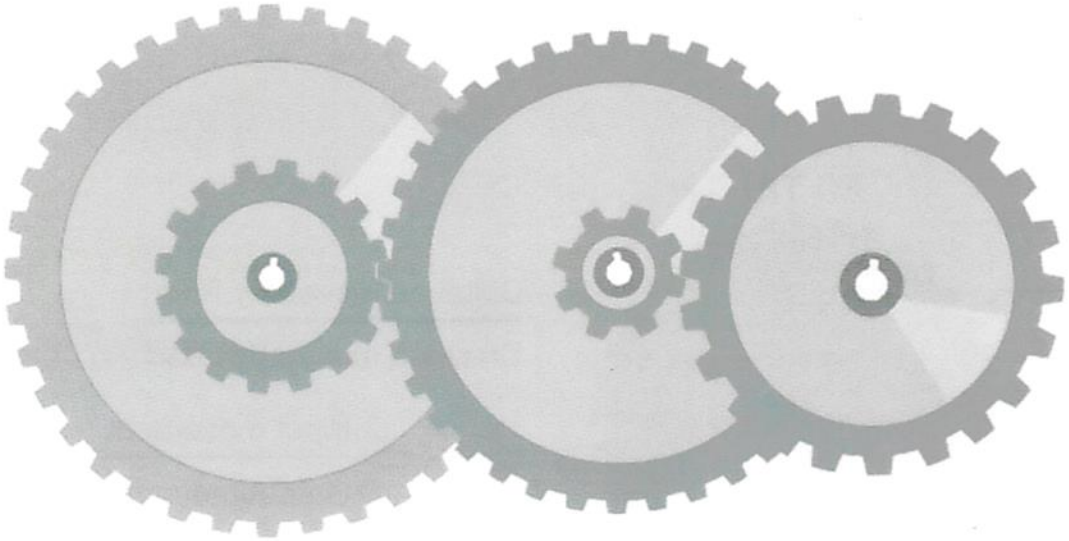
MATHEMATICAL SKILLS

GEARS, GEAR TRAINS AND COMPOUND GEARS

ASSOCIATED EXAMINATION QUESTIONS



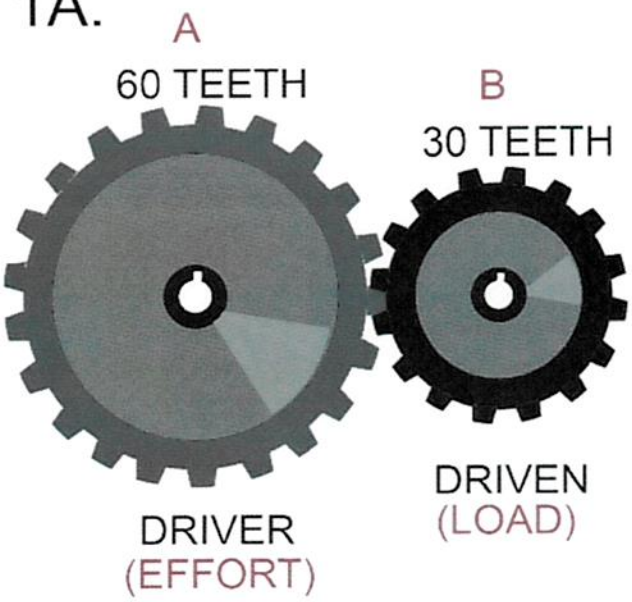
DESIGN AND TECHNOLOGY



CALCULATING GEAR RATIO (VELOCITY RATIO)

In examinations, one of the first questions will be - to work out the 'gear ratio' (sometimes called velocity ratio). As a guide - always assume that the larger gear revolves one revolution. The number of rotations of the second gear has then to be worked out.

1A.



GEAR RATIO / VELOCITY RATIO

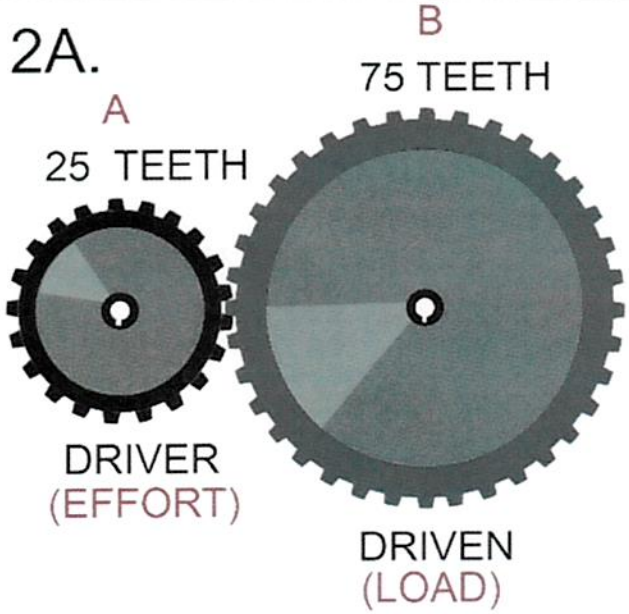
$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \_\_\_\_\_$$

$$= - = \frac{\text{Input movement}}{\text{Output movement}}$$

$$= \text{Driver : Driven}$$

:

2A.



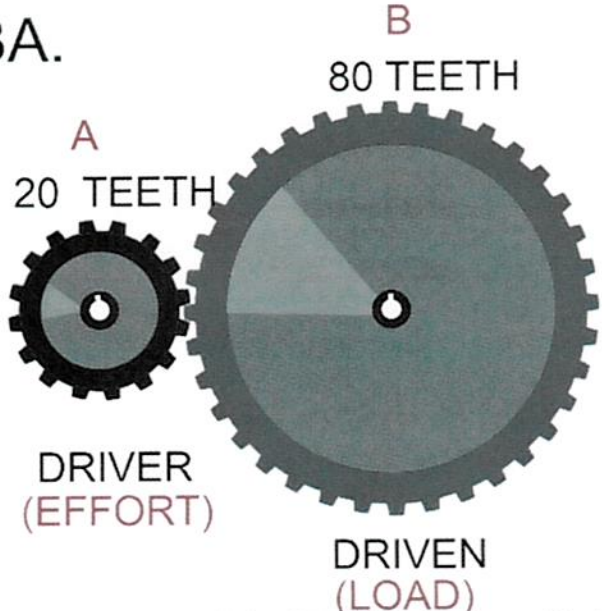
$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \_\_\_\_\_$$

$$= - = \frac{\text{Input movement}}{\text{Output movement}}$$

$$= \text{Driver : Driven}$$

:

3A.



$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \_\_\_\_\_$$

$$= - = \frac{\text{Input movement}}{\text{Output movement}}$$

$$= \text{Driver : Driven}$$

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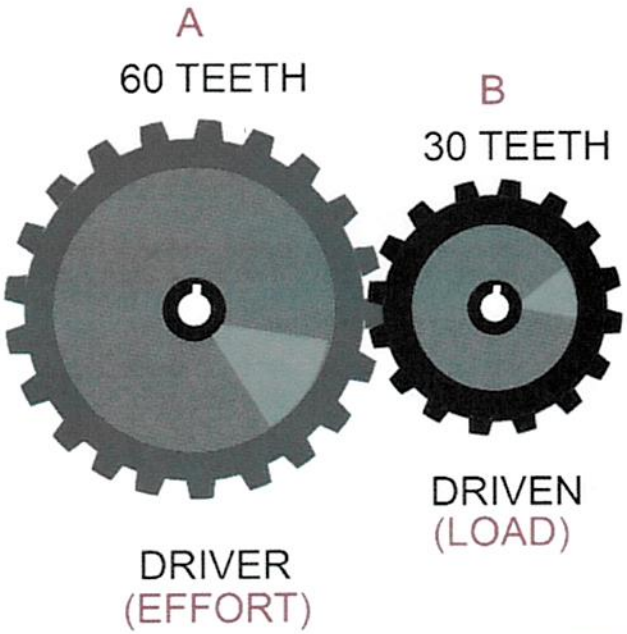
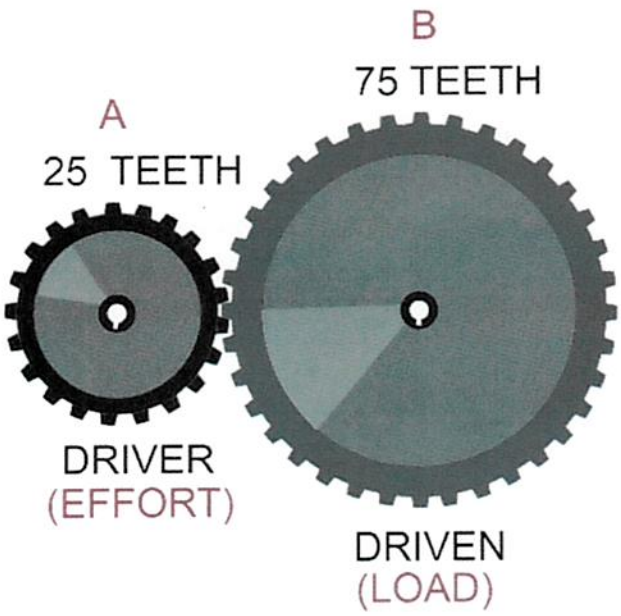
CALCULATING REVOLUTIONS PER MINUTE (RPM)



GEAR A	GEAR B
60 teeth	30 teeth
120 rpm	

— =

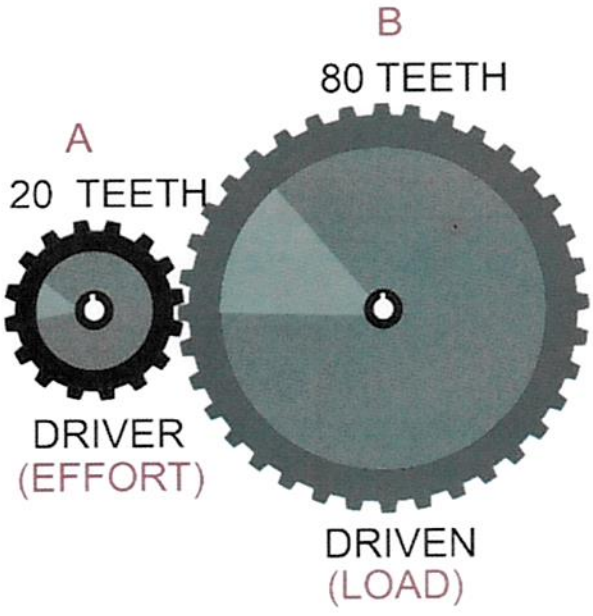
= = revs/min



GEAR A	GEAR B
25 teeth	75 teeth
60 rpm	

— =

= — = revs/min



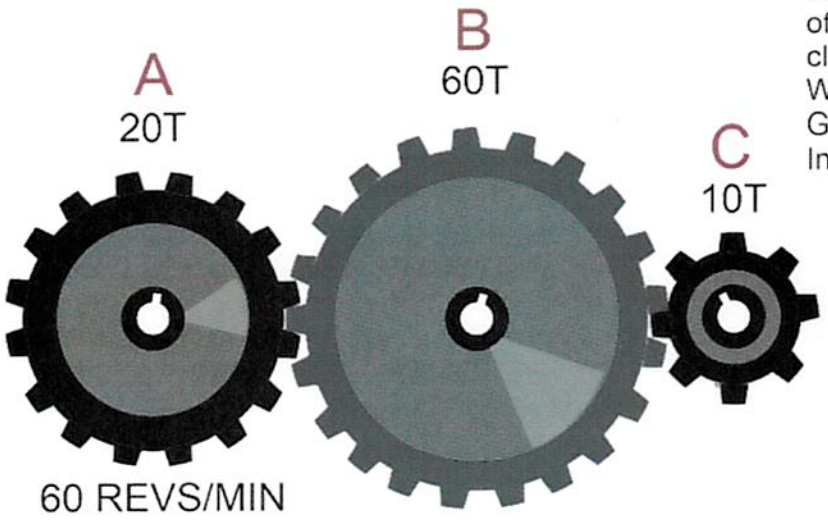
GEAR A	GEAR B
20 teeth	80 teeth
100 rpm	

— =

= — = revs/min

GEAR TRAINS - EXAMPLE QUESTIONS

When faced with three gears the question can be broken down into two parts. First work on Gears A and B. When this has been solved work on gears B and C.



The diagram above shows a gear train composed of three gears. Gear A revolves at 60 revs/min in a clockwise direction.
What is the output in revolutions per minute at Gear C?
In what direction does Gear C revolve ?

GEAR A	GEAR B	GEAR C
20 teeth	60 teeth	10 teeth
60 rpm		

First work out the speed at Gear B. $\frac{\text{\_\_ teeth}}{\text{teeth}}\ \frac{B}{A} =$

$= \frac{60_{rpm}}{\text{\_\_}} =$ ___revs/min at 'B'

(Remember B is larger than A therefore, B outputs less revs/min and is slower)

Next, take B and C. C is smaller, therefore, revs/minute will increase and rotation will be faster.

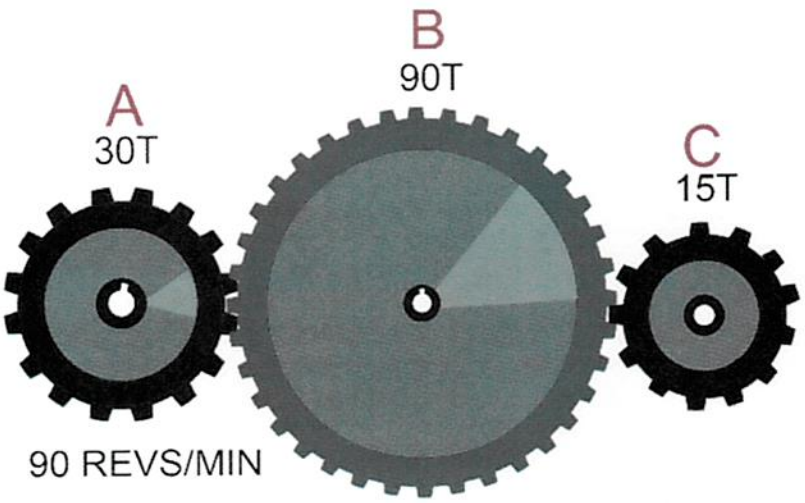
$\frac{\text{\_\_ teeth}}{\text{teeth}}\ \frac{B}{C} =$

__REVS X __ = ____revs/min at 'C'

What direction does C revolve ?
A is clockwise, B consequently is anti-clockwise and C is therefore _____

GEAR TRAINS - EXAMPLE QUESTIONS AND ANSWERS

When faced with three gears the question can be broken down into two parts. First work on Gears A and B. When this has been solved work on gears B and C.



The diagram opposite shows a gear train composed of three gears. Gear A revolves at 90 revs/min in a clockwise direction.
What is the output in revolutions per minute at Gear C?
In what direction does Gear C revolve ?

GEAR A	GEAR B	GEAR C
30 teeth	90 teeth	15 teeth
90 rpm		

First work out the speed at Gear B. $\_\_ \frac{\text{teeth } B}{\text{teeth } A} =$

$= \frac{90_{rpm}}{\quad} = \_\_\_\_$ revs/min at 'B'

(Remember B is larger than A therefore, B outputs less revs/min and is slower)

Next, take B and C. C is smaller, therefore, revs/minute will increase and rotation will be faster.

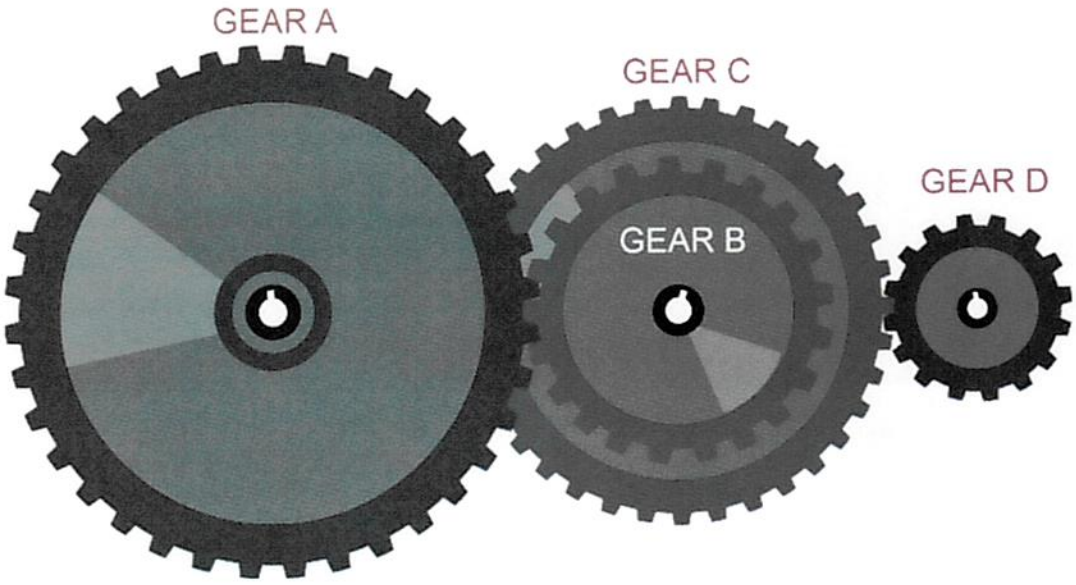
$\_\_ \frac{\text{teeth } B}{\text{teeth } C} =$

__ REVS X __ = ___ revs/min at 'C'

What direction does C revolve ?
A is clockwise, B consequently is anti-clockwise and C is therefore _____

COMPOUND GEARS - EXAMPLE QUESTIONS AND ANSWERS

Below is a question regarding 'compound gears'. Gears C and B represent a compound gear as they appear 'fixed' together. When drawn with a compass they have the same centre. Two gears 'fixed' together in this way rotate together and at the same RPM. When answering a question like this split it into two parts. Treat gears A and B as one question AND C and D as the second part.



This is an example of a "compound gear train". Gear A rotates in a clockwise direction at 30 revs/min. What is the output in revs/min at D and what is the direction of rotation ?

GEAR A	GEAR B	GEAR C	GEAR D
120 teeth	40 teeth	80 teeth	20 teeth

First find revs/min at Gear B. $\frac{\text{\_\_\_ teeth}}{\text{teeth}}\ \frac{B}{A} =$

__ rpm X __ = __ rpm / min

B is smaller therefore it rotates faster and revs/min increase.

C is fixed to B and therefore, rotates at the same speed.

__ REVS/MIN at C

Next find revs/min at Gear D. $\frac{\text{\_\_\_ teeth}}{\text{teeth}}\ \frac{C}{D} =$

__ rpm (at C) X _ = ___ rpm / min

D is smaller than C, therefore rotates faster (increased revs/min).

A revolves in a clockwise direction, B is therefore anti-clockwise, C is fixed to B and is also anti-clockwise, which means D revolves in a _____ __direction.