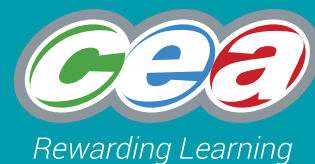


Support Material



Unit 2

**GCSE**  
**Further Mathematics**

## UNIT 2

<b>Resources - Unit 2</b>	<b>Activity</b>	<b>Specification Learning Outcome</b>
Constant acceleration formulae	Worksheet – simple substitution and calculation exercises	Use constant acceleration formulae
Constant acceleration formulae	Worksheet – slightly more challenging questions	Use constant acceleration formulae
Application of equations of motion to solve questions on uniformly accelerated motion	Card exercises	Use constant acceleration formulae
Application of equations of motion to solve questions on free fall motion	Card exercises	Use constant acceleration formulae
Application of the Laws of Motion	Worksheet	Application of $F = ma$ to a body on an inclined plane
Application of Newton's Laws to simple problems	Card Exercises	Application of $F = ma$ to a body in horizontal motion
Application of Newton's Laws to the relationship between mass and weight	Card Exercises	Application of $F = ma$ to mass to find its weight.
Meaning of Resistance per unit mass	Card Exercises	Forces acting on masses

## Unit 2: CONSTANT ACCELERATION FORMULA

### WORKSHEET 1

This worksheet provides straightforward substitution and calculation questions based on the four constant acceleration equations.

1  $v = u + at$

- Find
- (i)  $v$  when  $u = 6$ ,  $a = 0.5$ ,  $t = 8$
  - (ii)  $u$  when  $v = 20$ ,  $a = 3$ ,  $t = 6$
  - (iii)  $a$  when  $u = 5$ ,  $v = 19$ ,  $t = 2$
  - (iv)  $t$  when  $u = 6$ ,  $v = 46$ ,  $a = 10$

2  $s = ut + \frac{1}{2}at^2$

- Find
- (i)  $s$  when  $u = 6$ ,  $a = 0.5$ ,  $t = 8$
  - (ii)  $u$  when  $s = 66$ ,  $a = 3$ ,  $t = 6$
  - (iii)  $a$  when  $s = 24$ ,  $u = 5$ ,  $t = 2$
  - (iv)  $t$  when  $s = 56$ ,  $u = 6$ ,  $a = 4$

3  $v^2 = u^2 + 2as$

- Find
- (i)  $v$  when  $u = 26$ ,  $a = -3$ ,  $s = 112$
  - (ii)  $u$  when  $v = 17$ ,  $a = 4$ ,  $s = 30$
  - (iii)  $a$  when  $u = 8$ ,  $v = 38$ ,  $s = 138$
  - (iv)  $s$  when  $u = 26$ ,  $v = 4$ ,  $a = -2$

4  $s = \frac{1}{2}(u + v)t$

- Find
- (i)  $s$  when  $u = 26$ ,  $v = 2$ ,  $t = 8$
  - (ii)  $t$  when  $s = 30$ ,  $u = 7$ ,  $v = 17$
  - (iii)  $u$  when  $s = 138$ ,  $t = 6$ ,  $v = 38$
  - (iv)  $v$  when  $s = 165$ ,  $t = 11$ ,  $u = 26$

## Worksheet 1 - Answers

1 (i) 10	(ii) 2	(iii) 7	(iv) 4
2 (i) 64	(ii) 2	(iii) 7	(iv) 4 or -7
3 (i) 2	(ii) 7	(iii) 5	(iv) 165
4 (i) 112	(ii) 2.5	(iii) 8	(iv) 4

## Unit 2: CONSTANT ACCELERATION FORMULA

### WORKSHEET 2

This worksheet provides slightly more challenging questions on the four constant acceleration equations.

- 1** A body moving at a constant acceleration reaches a velocity of 34m/s in 7s

It reaches a velocity of 42m/s in a further 2s

Find the (i) acceleration (ii) the initial velocity (iii) the velocity after 5sec

- 2** A body moving at a constant acceleration travels 52m in 4s.

It then travels a further 56m in the next 2s.

Find the (i) acceleration (ii) the initial velocity (iii) the time it takes to reach a velocity of 6m/s

- 3** A body moving at a constant acceleration reaches a velocity of 14m/s in 2s

It reaches a velocity of 26m/s in a further 4s

Find the (i) acceleration (ii) the initial velocity (iii) the distance travelled after 5sec

- 4** A body moving at a constant acceleration travels 28m in 2s.

It then travels a further 152m in the next 4s.

Find the (i) acceleration (ii) the initial velocity (iii) its velocity after 3.5s

- 5** A body moving at a constant acceleration reaches a velocity of 19m/s in 6s

It reaches a velocity of 24m/s in a further 2s

Find the (i) acceleration (ii) the initial velocity (iii) the time taken to reach a velocity of 12m/s

- 6** A body moving at a constant acceleration travels 11.4m in 3s.

It then travels a further 6.2m in the next second.

Find the (i) acceleration (ii) the initial velocity (iii) the time it takes to reach a velocity of 5m/s

## Worksheet 2 – Answers

1 (i) $4\text{m/s}^2$	(ii) $6\text{m/s}$	(iii) $26\text{m/s}$
2 (i) $5\text{m/s}^2$	(ii) $3\text{m/s}$	(iii) $0.6\text{s}$
3 (i) $3\text{m/s}^2$	(ii) $8\text{m/s}$	(iii) $77.5\text{m}$
4 (i) $8\text{m/s}^2$	(ii) $6\text{m/s}$	(iii) $34\text{m/s}$
5 (i) $2.5\text{m/s}^2$	(ii) $4\text{m/s}$	(iii) $3.2\text{s}$
6 (i) $1.2\text{m/s}^2$	(ii) $2\text{m/s}$	(iii) $2.5\text{s}$

## Unit 2: CONSTANT ACCELERATION FORMULA

### CARDS 1

The material below might be copied on to cards and laminated. Working in pairs, learners select a card at random and solve the problem presented. When finished the card is returned to the pile and learners select another. The class might be tasked to see which pair solves most problems correctly in 5 minutes.

**1**

A body travels 64m in 8sec at a constant acceleration of  $0.5 \text{ m/s}^2$

Find its initial velocity

**2**

A body moving at  $2 \text{ m/s}$  accelerates uniformly at  $3 \text{ m/s}^2$  for 6sec

Find its final velocity

**3**

A body increases its velocity from  $5 \text{ m/s}$  to  $19 \text{ m/s}$  in 2sec moving at a constant acceleration

Find the distance travelled.

**4**

A body moving at  $6 \text{ m/s}$  accelerates uniformly at  $10 \text{ m/s}^2$  and travels 104m

Find its final velocity

**5**

A body moving at  $26 \text{ m/s}$  decelerates uniformly for 8sec at  $3 \text{ m/s}^2$

Find the distance it travels.

6

A body accelerates uniformly from 7m/s to 17m/s in 2.5sec

Find its acceleration

7

A body accelerates uniformly from 8m/s to 38m/s in 6sec

Find the distance travelled.

8

A body decelerates uniformly at  $2 \text{ m/s}^2$  to a velocity of 4m/s after travelling 165m

Find its initial velocity

### Answers

1 6 m/s	2 20 m/s
3 24 m	4 46 m/s
5 112 m	6 $4 \text{ m/s}^2$
7 138 m	8 26 m/s



## Unit 2: CONSTANT ACCELERATION FORMULA

### CARDS 2

The questions below all relate to free fall motion. The material might be copied on to cards and laminated. Working in pairs, learners select a card at random and solve the problem presented. When finished the card is returned to the pile and learners select another. The class might be tasked to see how long it takes to solve all 6 questions.

1.

An object drops from rest to the ground from a height of 8m.

What is its velocity on hitting the ground?

2.

An object drops from rest to the ground in 6sec.

What is its velocity on hitting the ground?

3.

An object drops from rest to the ground in 4sec.

How far did it fall?

4.

An object drops from rest to the ground and its velocity on hitting the ground is 5m/s.

How far did it fall?

5.

An object drops from rest to the ground and its velocity on hitting the ground is 15m/s.

How long did it take to hit the ground?

6.

An object drops from rest 45m to the ground.

How long did it take to hit the ground?

### Answers

1 12.6m/s	2 60m/s
3 80m	4 1.25m
5 1.5sec	6 3 sec

## Unit 2: Newton's Laws of Motion

### Worksheet 3

This worksheet gives learners the opportunity to practice their skills to solve kinematics problems for a body on an inclined plane.

Give your answers to 2 decimal places as necessary.

- 1 A block mass 7kg rests on a rough plane inclined at  $24^\circ$  to the horizontal. A force of 80N parallel to, and acting up, the plane is applied to the body and it begins to accelerate reaching 18m/s in 6s.

Find the frictional force.

- 2 A block mass 14kg rests on a rough plane inclined at  $40^\circ$  to the horizontal. A force of PN parallel to, and acting up, the plane is applied to the body and it begins to accelerate reaching 8m in 2s. The frictional force acting on the body is 39N.

Find P

- 3 A block rests on a rough plane inclined at  $25^\circ$  to the horizontal. A force of 46N parallel to, and acting up, the plane is applied to the body and it begins to accelerate reaching 12m in 10s. The frictional force acting on the body is 28N.

Find the mass of the body.

- 4 A block mass 6kg rests on a rough plane inclined at  $24^\circ$  to the horizontal. A force of 72N parallel to, and acting up, the plane is applied to the body and it begins to accelerate reaching 6m/s in 4m.

Find the frictional force.

- 5 A block mass 2.7kg rests on a rough plane inclined at  $16^\circ$  to the horizontal. A force of PN parallel to, and acting up, the plane is applied to the body and it begins to accelerate reaching 5.4m/s in 9s. The frictional force acting on the body is 32N.

Find P

- 6 A block rests on a rough plane inclined at  $30^\circ$  to the horizontal. A force of 68N parallel to, and acting up, the plane is applied to the body and it begins to accelerate reaching 12m/s in 4s. The frictional force acting on the body is 44N.

Find the mass of the body.

### Worksheet 3 - Answers

1 30.53 N	2 184.99 N	3 4.03 kg
4 20.60 N	5 41.06 N	6 3 kg

## Unit 2: Newton's Laws of Motion

### CARDS 3

Working together in pairs match the following cards

$$F = 8\text{N and MASS} = 4\text{kg}$$

$$F = 3\text{N and MASS} = 5\text{kg}$$

$$F = 8\text{N and } a = 2 \text{ m/s}^2$$

$$F = 15\text{N and } a = 6 \text{ m/s}^2$$

$$a = 1.2 \text{ m/s}^2 \text{ and MASS} = 20\text{kg}$$

$$a = 5 \text{ m/s}^2 \text{ and MASS} = 6\text{kg}$$

$$a = 2 \text{ m/s}^2$$

$$a = 0.6 \text{ m/s}^2$$

$$\text{MASS} = 4\text{kg}$$

$$\text{MASS} = 2.5\text{kg}$$

$$F = 24\text{N}$$

$$F = 30\text{N}$$

## ANSWERS

### CARDS 3

The pairs of matched cards are:

$$F = 8\text{N and MASS} = 4\text{kg}$$

and

$$a = 2\text{ m/s}^2$$

$$F = 3\text{N and MASS} = 5\text{kg}$$

and

$$a = 0.6\text{ m/s}^2$$

$$F = 8\text{N and } a = 2\text{ m/s}^2$$

and

$$\text{MASS} = 4\text{kg}$$

$$F = 15\text{N and } a = 6\text{ m/s}^2$$

and

$$\text{MASS} = 2.5\text{kg}$$

$$a = 1.2\text{ m/s}^2 \text{ and MASS} = 20\text{kg}$$

and

$$F = 24\text{N}$$

$$a = 1.2\text{ m/s}^2 \text{ and MASS} = 20\text{kg}$$

and

$$F = 24\text{N}$$

$$a = 5\text{ m/s}^2 \text{ and MASS} = 6\text{kg}$$

and

$$F = 30\text{N}$$

## Unit 2: Newton's Laws of Motion

### CARDS 4

Learners are provided with a pack of 14 cards and tasked with matching them as quickly as possible. Working together in pairs, they match the following cards

Weight = 8N

MASS = 80kg

Weight = 40N

MASS = 1.6kg

Weight = 6.4N

MASS = 4.6kg

Weight = 16N

MASS = 0.64kg

Weight = 800N

MASS = 0.05kg

Weight = 46N

MASS = 4kg

Weight = 0.5N

MASS = 160kg

Weight = 1600N

MASS = 0.8kg

### Answers to Cards 4

Weight = 8N

MASS = 0.8kg

Weight = 40N

MASS = 4kg

Weight = 6.4N

MASS = 0.64kg

Weight = 16N

MASS = 1.6kg

Weight = 800N

MASS = 80kg

Weight = 46N

MASS = 4.6kg

Weight = 0.5N

MASS = 0.05kg

Weight = 1600N

MASS = 160kg

## Unit 2: Newton's Laws of Motion

### CARDS 5

Learners are provided with a pack of 14 cards and tasked with matching them as quickly as possible. Working together in pairs, they match the following cards

Resistance = 0.6N per kg  
Mass = 1000kg

Resistance = 1.24N per kg  
Mass = 4800kg

Resistance = 0.94N per kg  
Mass = 750kg

Resistance = 0.76N per kg  
Total resistance = 228N

Total Resistance = 608N  
Mass = 760kg

Total Resistance = 117.6N  
Mass = 84kg

Resistance = 1.2N per kg  
Total resistance = 1152N

Total resistance = 705N

Total resistance = 600N

Total resistance = 5952N

Mass = 960kg

Mass = 300kg

Resistance = 1.4N per kg

Resistance = 0.8N per kg

### Answers to Cards 5

Resistance = 0.6N per kg  
Mass = 1000kg

Resistance = 1.24N per kg  
Mass = 4800kg

Resistance = 0.94N per kg  
Mass = 750kg

Resistance = 0.76N per kg  
Total resistance = 228N

Total Resistance = 608N  
Mass = 760kg

Total Resistance = 117.6N  
Mass = 84kg

Resistance = 1.2N per kg  
Total resistance = 1152N

Total resistance = 600N

Total resistance = 5952N

Total resistance = 705N

Mass = 300kg

Resistance = 0.8N per kg

Resistance = 1.4N per kg

Mass = 960kg

