designclass
design | engineering | technology



RENDERING · PASS 160 / 160

RENDER STUDIO

Lights. Camera. Render.

Turn a grey CAD model into a photo-real product shot. Learn how designers use materials, lights, cameras and render settings, then save pictures that look good enough to sell the product. Every chapter ends with tasks: write your answers in the spaces.

BOOKLET	SUBJECT	LEVEL	LEADS TO
Course notes	Graphics	BGE · Level 2	N5 Graphic Communication · N5 Design and Manufacture

NAME _____ CLASS _____

WELCOME TO THE STUDIO

What is a render?

A **render** is a realistic picture that a computer makes from a **3D CAD model**. The computer works out how light hits each part of the model, how it bounces off shiny plastic or shines through clear acrylic, and where the shadows fall.

Designers use renders to show a product **before it has been made**. In this project you work in a **render studio**. Four clients have sent you a 3D model and a brief, and your job is to make each grey model look real enough to sell.



BEFORE · the STEP file as it arrives



AFTER · the same model, rendered

WE ARE LEARNING TO

- explain why designers make renders and which CAD files to use
- use colour, material, texture and light to make a 3D model look realistic
- choose camera views and render settings, and save the right picture file

I CAN

- import a STEP file and apply the materials and decal a client asks for
- light a product so it has highlights, shadows and reflections
- save a clean PNG and explain my choices using key words

KEY WORDS words to learn · **N5 LINK** where it comes up at National 5 · **TRY IT** steps in RenderClass · **YOUR TURN** tasks to write in

YOUR TURN TASK 0 Starter: photo or render?

0.1 Look closely. Tick each picture you think is a real **photograph**.



☐ photo



☐ photo



☐ photo



☐ photo

0.2 Write one clue that can tell you a picture is a render, not a photo.

0.3 Which of the four products would you most like to render, and why?

SCENE

01 Why do designers make renders?

Making a real product costs time and money. A render lets everyone see the product while it is still only a file.

01
See it before it is made
A mould for a plastic casing can cost thousands of pounds. Everyone can see the product first.

02
Try ideas quickly
Change a colour or material in seconds and compare options side by side.

03
Sell the product
Adverts, websites and packaging, often before the first one is made.

04
Get feedback
Show clients and the **target market**, then improve the design.

Advantages of renders	Limitations of renders
Cheaper and quicker than real prototypes	You cannot hold it to feel its weight, texture or comfort
Easy to change colours, materials and views	It can make a product look better than the real thing
Shows the product before it exists	It needs a good computer, time and skill

N5 LINK

Graphic Communication sorts graphics by purpose: **preliminary** (developing ideas), **production** (information to make it) and **promotional** (advertising and selling).

YOUR TURN TASK 1 Why render?

1.1 Pixel Pod Games wants pictures of its console months before the first one is made. Give **two** reasons why it should use renders.

1.2 Give **one** limitation of showing customers a render instead of a real prototype.

1.3 Tick the **type of graphic** for each example.

Example	Preliminary	Production	Promotional
(a) Three quick renders comparing colour ideas for the Pixel Pod	☐	☐	☐
(b) A working drawing with dimensions for the factory	☐	☐	☐
(c) A render of the Pixel Pod on its website, with the price	☐	☐	☐

KEY WORDS

render a realistic picture made by a computer from a 3D model

target market the group of people a product is designed for

SCENE

02 CAD file types

To move a model into another program, such as a renderer, you export it as a file both programs understand.

1 Model it — CAD program: Fusion · Onshape · SolidWorks — `.f3d`

→ **2 Export it** — Neutral file: STEP keeps the exact shape — `.step`

→ **3 Render it** — RenderClass: materials · lights · camera · quality — `3D → 2D`

→ **4 Save it** — Image file: PNG for quality and see-through — `.png`

→ **5 Use it** — Promotional: advert · web page · presentation — `DTP`

A **native file** is the CAD program's own file type (Fusion `.f3d`, SolidWorks `.sldprt`). It keeps sketches, the feature history and assembly parts. A **neutral file** opens in lots of programs: you make one with **Export**, and open it elsewhere with **Import**.

File	What is inside	Best for
STEP `.step`	The **exact** shape, smooth curves, separate parts	Sharing CAD models; rendering
STL `.stl`	A surface of flat **triangles**, usually no colour	3D printing
OBJ `.obj`	A mesh of flat faces, linked to materials and pictures	Games and animation



STEP: smooth curves



STL: flat triangles

TRY IT

RenderClass turns a STEP file into triangles to draw it. `Smoothness of curves` : `Rough` is fastest, `Smooth` looks best.

YOUR TURN — TASK 2 File detective

2.1 Write the best file type for each job: **STEP**, **STL**, **OBJ** or **native file**.

(a) I want to 3D print my keyring. _____

(b) I want to send my model to RenderClass with perfectly smooth curves. _____

(c) I want to change the fillet I made last week in Fusion. _____

(d) A games studio wants a mesh with links to its materials and pictures. _____

2.2 Jo Smith saved her Pixel Pod hero shot as *render1.png*. Write a better file name using **Surname_Product_Shot.png**.

_____

2.3 Why should you always keep your **native** CAD file, even after exporting a STEP file?

_____

N5 LINK

Graphic Communication asks about **importing and exporting** and **file management**.

KEY WORDS

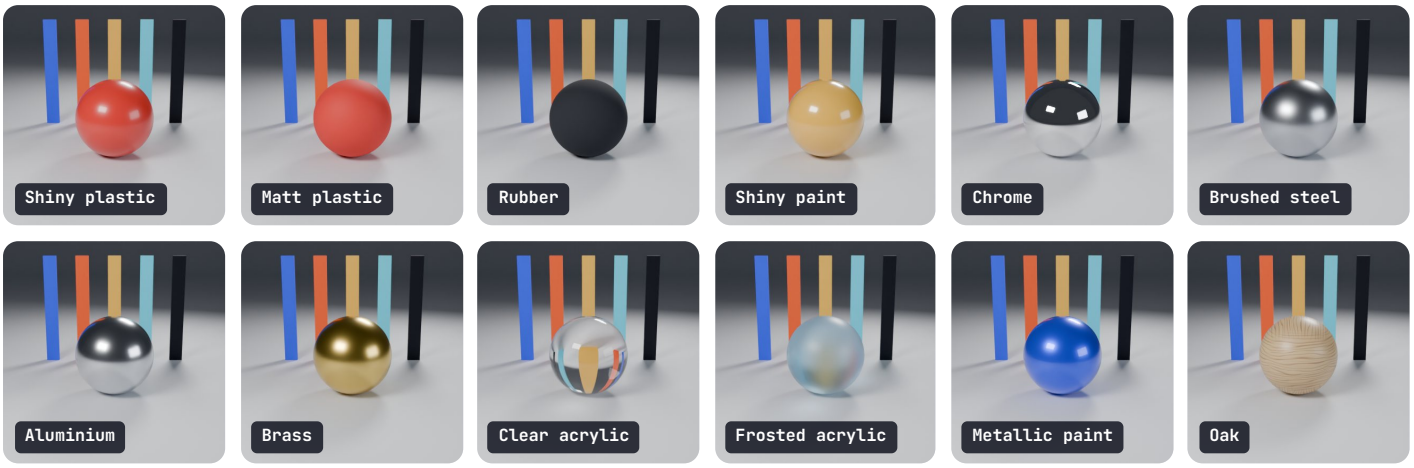
native file — the CAD program's own file type

export — save a copy as a different file type

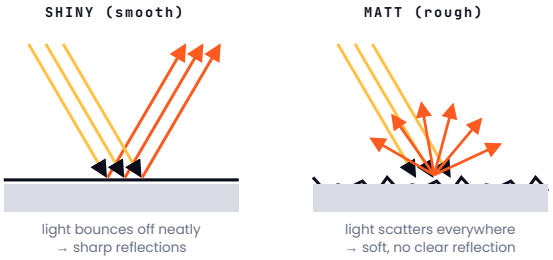
SCENE

03 Choosing materials

A material tells the renderer how a surface behaves in light: colour, shiny or matt, metal or not, and whether light passes through.



A **shiny** (smooth) surface reflects light neatly, giving sharp **reflections** and bright **highlights**. A **matt** (rough) surface scatters light everywhere, so its colour looks soft and even.

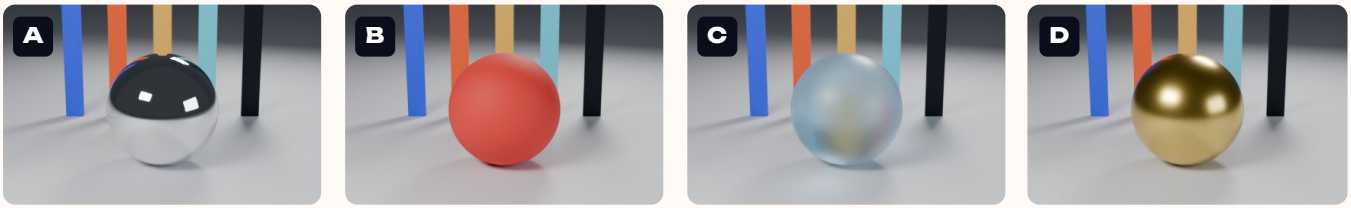


Metals reflect their surroundings and tint the reflections with their own colour. In RenderClass, pick a `pot`, choose a family such as `Metal`, then click the parts. Light passes through **transparent** materials (you see clearly through them) and **translucent** ones (you cannot see clearly). Clear materials bend light: this is **refraction**.



YOUR TURN TASK 3a Material detective

3.1 Name each material, then write **one clue** that gave it away. Use the balls at the top of the page to help.



clue: clue: clue: clue:

3.2 Describe the difference between the way light reflects from a **shiny** surface and from a **matt** surface.

Real materials, textures and decals

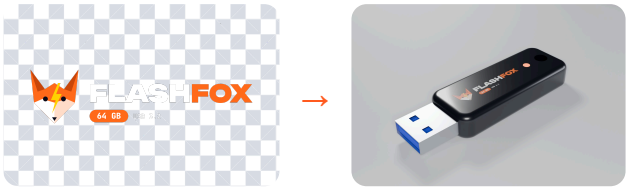
A render only looks believable if each part uses a material it could really be made from. Think like a manufacturer: **what would this part be made of, and how?** The Pixel Pod casing would be **ABS**, a tough thermoplastic shaped by **injection moulding**. The Tempo bezel would be **brass**, a non-ferrous alloy that does not rust.

Textures are patterns wrapped onto a surface, like wood **grain**. RenderClass draws grain for `Oak`, `Pine`, `Mahogany` and `Beech`, and a smooth, even texture for `MDF`.

A **decal** is a picture stuck onto the surface of a model: a logo, a label or a screen. Use a **PNG** with a see-through background, then set its `Size`, `Turn` and `Finish`.



FIG 3.1 · Oak boards, beech pegs and a matt decal



YOUR TURN TASK 3b Think like a manufacturer

3.3 Complete the table. Choose from: **ABS**, **steel**, **acrylic**, **oak**.

Part	Real-life material	Why it is used
(a) Games console casing		tough and resists knocks; can be injection moulded
(b) Clock stand	**acrylic**	
(c) USB connector		strong and stiff, so it keeps its shape
(d) Shelf boards	**oak**	

3.4 Why should a decal be a PNG with a **see-through background**?

3.5 The FlashFox logo is printed onto shiny black plastic. Which decal **Finish** would you choose, and why?

3.6 A client wants a **matt red** casing. Which material would you choose in RenderClass, and what colour would you set?

N5 LINK

Design and Manufacture: materials such as **ABS, acrylic, brass, steel, oak, beech** and processes like **injection moulding**.

KEY WORDS

texture a pattern on a surface, such as wood grain

decal a picture applied to the surface of a model

SCENE

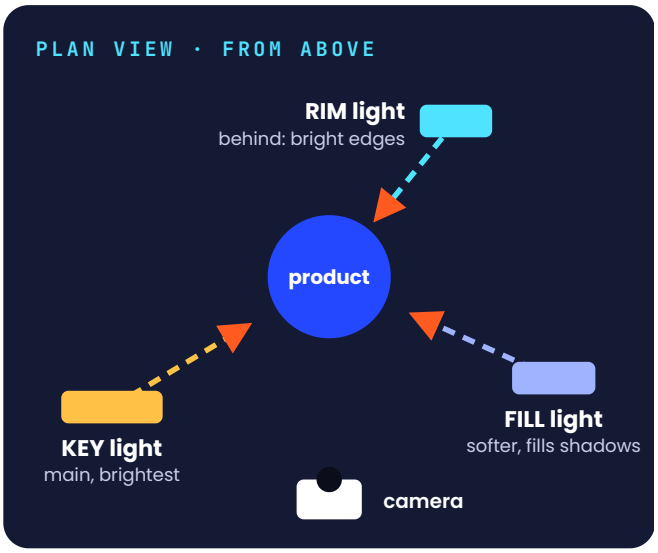
04 Lights and shadows

Light shows the shape of a product. Photographers and render artists use the same tricks.

Product photographers often use **three-point lighting**:

- **Key light**: the main, brightest light, to one side of the camera. It makes the highlights and main shadows.
- **Fill light**: a softer light on the other side. It lightens the shadows so detail can be seen.
- **Rim light** (back light): behind the product. It brightens the edges so the product stands out from the background.

A **small** light gives **hard** shadows with sharp edges. A **large** light, like a window or softbox, gives **soft** shadows. Most product shots use soft light.





KEY only: very dark shadows



KEY + FILL: detail returns



+ RIM: edges stand out



small light: **hard** shadow



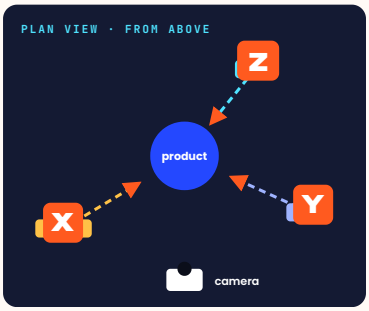
large light: **soft** shadow

Many renderers light the model with an **HDRI**: a 360° photo of a real place, wrapped round the model like a dome. Its windows and lamps light the model and appear in reflections.

TRY IT

In `Lights` pick the `Three-point` recipe. In `Studio` try `Soft studio`, `Bright studio` or `Loft window`.

YOUR TURN **TASK 4a** **Light the studio**



4.1 Name lights X, Y and Z.

X _____

Y _____

Z _____

4.2 What does light **Y** do?

4.3 How can a render artist make shadows **softer**?

Ground it: shadows and backgrounds



FIG 4.1 · No floor, no shadow



FIG 4.2 · A floor with a soft **contact shadow**

The dark shadow where a product touches the floor is the **contact shadow**. Without it, the product looks like a sticker pasted onto the picture. Choose a background that suits the client: **plain** (clean, for shop websites), **dark** (dramatic) or **see-through** (a cut-out to place on any layout). In `Studio`, choose `Fade-out floor` or `Backdrop` to ground your product.

YOUR TURN TASK 4b Ground it

4.4 Look at Fig 4.1. Explain why it looks less realistic than Fig 4.2.

4.5 Tick the best background for each client.

Client and job	Plain	Dark	See-through
(a) Bothy: a photo for its online shop	☐	☐	☐
(b) Tempo: a dramatic magazine advert	☐	☐	☐
(c) FlashFox: a cut-out to drop onto an orange advert	☐	☐	☐

4.6 Plan the lighting for your own client. Which studio lights and background will you use, and why? Use key words.

N5 LINK

Graphic Communication asks you to show **light, shade, shadow, reflection, tone, material and texture** in your illustrations, and to apply a **light source** in 3D CAD. That is exactly what you are doing here.

KEY WORDS

contact shadow — the dark shadow where a product touches the floor

HDRI — a 360° photo of a real place, used to light a 3D scene

SCENE

05 Camera and composition

Where you put the camera decides what people notice first.



FRONT: flat, no depth



THREE-QUARTER: front, side and top



LOW ANGLE: bold and dramatic

A **three-quarter view** (from a front corner, a little above) shows three faces at once, like an isometric sketch, so the shape is clear. The **lens** is measured in mm: a **wide** lens (small number) stretches things close to the camera; a **portrait** lens (bigger number) keeps proportions true.



Wide 20 mm, close up



Portrait 85 mm

A shallow **depth of field** blurs the background so the eye goes to the sharp part. For good **composition**, fill most of the frame, leave a little space round the product, and try the **rule of thirds**.



Depth of field: connector sharp, the rest blurred

YOUR TURN TASK 5a Frame the shot

5.1 Which view, **P**, **Q** or **R**, shows the shape of the clock best? Explain why.

5.2 Describe what a shallow **depth of field** does to a render.

5.3 Plan your hero shot: which **lens** and which **view** will you use, and why?

SKETCH YOUR HERO SHOT

Use the rule-of-thirds lines.

N5 LINK

Design and Manufacture: a good render lets a client **evaluate** a design idea against the **specification** before a prototype is made.

KEY WORDS

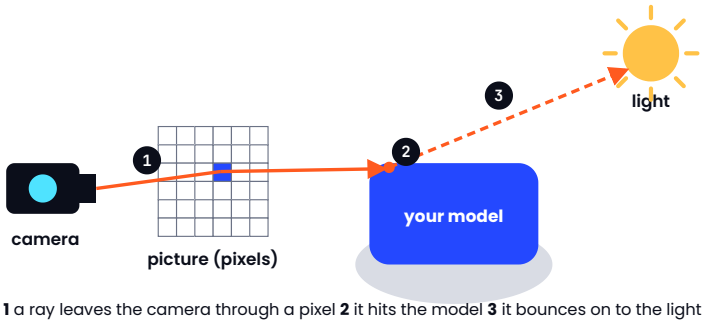
composition how the product is placed and arranged in the frame

depth of field how much of the picture, from front to back, is sharp

Render settings

RenderClass is a **ray tracer**. For every pixel it sends a **ray** from the camera, follows it as it bounces round the scene, and works out the pixel's colour. Doing this once for the whole picture is a **pass**. Each pass is added to the last, so the picture keeps getting cleaner.

Too few passes leave speckles called **noise**. Clear materials also need enough **light bounces**, or they look dark. A picture is made of **pixels**: its **resolution** is how many pixels wide and high it is.



1 a ray leaves the camera through a pixel **2** it hits the model **3** it bounces on to the light
Every pass sends new rays through every pixel: more passes, cleaner picture.



4 passes: noise



512 passes: clean



too few **bounces**



6+ bounces: clear

TRY IT

`Quick`: a rough picture in seconds. `Good`: clean in about a minute. `Best`: your final picture (a few minutes). `More options` sets `Picture size`, `Stop after` (passes) and `Light bounces`.

YOUR TURN **TASK 5b** **Inside the ray tracer**

5.4 Number the steps **1**, **2**, **3** in the right order.

(a) The ray bounces off the model towards the light.

(b) A ray leaves the camera through a pixel.

(c) The ray hits the model.

5.5 **Describe** what noise is and **explain** how to get rid of it.

5.6 The clear acrylic stand looks dark and murky. Which setting should be higher?

5.7 Tick the quality you would use.

	Quick	Good	Best
(a) Trying out different lights and camera views	☐	☐	☐
(b) The final picture for your client	☐	☐	☐

KEY WORDS

ray tracer a renderer that follows rays of light from the camera into the scene

noise speckles in a render that has not had enough passes

KEY WORDS

pass one round of rays sent through every pixel

pixel one tiny square of colour in a digital picture

SCENE

06 Exporting your render

The file type you save decides how good the picture looks and what you can do with it next.

	PNG `.png`	JPEG `.jpg`
Quality	Keeps every pixel (**lossless**)	Throws detail away (**lossy**)
File size	Bigger	Smaller
See-through background	**Yes**	No
Best for	Renders, logos, decals	Photos on the web



Designers place renders into **promotional graphics** such as adverts and web pages, using **desktop publishing (DTP)** software. A PNG with a **transparent background** drops neatly onto any layout.

TRY IT

Press `Save picture (PNG)`. For a cut-out, open `More options` and tick `See-through background in the saved PNG`. Rename the file as soon as it downloads.

YOUR TURN **TASK 6 Save it right**

6.1 PNG or JPEG? Tick the best file type for each job.

Job	PNG	JPEG
(a) The final render for your client	☐	☐
(b) A holiday photo for a website where a small file matters	☐	☐
(c) A decal logo with a see-through background	☐	☐
(d) A cut-out product to drop onto an advert	☐	☐

6.2 What does **lossless** mean?

6.3 Give **one** reason why a see-through background helps the advert designer.

6.4 Write a short, catchy **headline** for your own advert using one of your renders.

6.5 Name the type of software used to lay out an advert.

KEY WORDS

lossy throws some detail away to make a smaller file

resolution the number of pixels across and down a picture

Your studio workflow

Open RenderClass at **detscotland.co.uk/RenderClass** in Chrome or Edge. Your model never leaves your computer.

01 Load
Open the STEP file. Use `Is it the right way up?`

02 Paint
A pot for each material in the brief.

03 Stickers
Add the decal PNG: size, turn, finish.

04 Camera & lights
Three-quarter view, a lighting recipe, a floor.

05 Save
Test on `Quick`, save on `Good` or `Best`.

PRO RENDER CHECKLIST · TICK EACH ONE WHEN YOUR RENDER PASSES

- [ ] Realistic materials that match the brief
- [ ] Highlights, shadows and reflections
- [ ] Three-quarter view; nothing cut off
- [ ] Saved as a PNG with a clear file name
- [ ] Decal: right size, right way up, right place
- [ ] Contact shadow: no floating
- [ ] No noise: saved on Good or Best
- [ ] Notes use key words

YOUR TURN **TASK 7 My render log**

Client and product	
Materials I used (part: material)	
Studio lights and floor	
Lens and view	
Quality and passes	
File name	

One thing I did well, using key words:

One thing I would improve, and how:

LIGHTS. CAMERA. RENDER.