1. Materials & Design

Sample Question:
A handheld mixer uses a thermosoftening polymer casing. Give two properties of this material and explain why they are suitable.

Worked Example Answer (4 marks)

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2. Electrical Power & Efficiency

Sample Question:
A small device uses a 5.0 V rechargeable battery and charges at 0.2 A.
(a) Calculate the power delivered to the battery.
(b) The charger is 80% efficient. Calculate the input power drawn from the mains.

Power = Voltage × Current.

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3. Mechanisms – Converting Motion

Sample Question:
A device requires rotary motion to be converted into oscillating motion. Sketch and describe a mechanism that achieves this.

Worked Example Answer (

4. Volume & Geometry (Sphere Calculation)

Sample Question:

A hollow plastic ball needs an internal volume of 30 cm^3 and has a wall thickness of 2 mm.

Calculate the external diameter.

Using the formula $V = 4/3\pi r^3$, rearrange to get r

To calculate arc length, use: $L = 2\pi r(\theta/360)$.

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5. Probability (Independent Events)

(Similar to Q2b)

Sample Question:
In a batch of 20,000 parts:

- **Probability of fault X = 0.03**
- **Probability of fault Y = 0.02**

(a) How many parts are expected to have fault X?
(b) How many are expected to have both faults?

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6. Arc Length & Chord Length

To calculate arc length, use: $L = 2\pi r(\theta/360)$.

Chord length uses trigonometry: $A = 2r \sin(\theta/2)$.

A wooden arc has:

Radius 800 mm

Angle 30°

(a) Find the arc length.

(b) Find the chord length.

Worked Example

7. Ethics & Responsible Sourcing

Sample Question:
Explain one social, one environmental, and one ethical reason why manufacturers should ensure responsible sourcing of lithium.

Worked Example Answer (6–8 marks)

8. Surface Mount Technology (SMT)

Sample Question:
Explain why SMT is suitable for mass production of small electronic products.

Worked Example Answer (4 marks)

Design Engineering Revision Guide with Explained Example Answers

1. Materials & Design

Thermosoftening polymers are used in product casings because they are both durable and easy to manufacture.

Example explained:

• Impact resistance – This means the material does not crack easily if the product is dropped. For students, think of it like a phone case that protects your phone when you drop it.

• Mouldability – When heated, these plastics can be shaped into comfortable, ergonomic forms. This is why toothbrush handles fit nicely in your hand.

2. Power & Efficiency

When calculating electrical power, remember: Power = Voltage × Current.

Example explained:

A device uses 5V and 0.2A. Multiply them: 5 × 0.2 = 1W.

If the charger is 80% efficient, it means only 80% of what goes in is used.

So Input = Output ÷ Efficiency = 1 ÷ 0.8 = 1.25W.

3. Geometry: Hollow Sphere

To find the radius of a hollow sphere, use the volume formula.

Example explained:

Internal volume = 30 cm^3. Using the formula $V = 4/3\pi r^3$, rearrange to get r.

After calculating the internal radius (1.92 cm), add the 2 mm wall thickness (0.2 cm).

Final external diameter = 4.24 cm.

4. Probability

Independent events multiply together.

Example explained:

Fault X happens 3% of the time → 0.03.

Y happens 2% → 0.02.

Both at same time: 0.03 × 0.02 = 0.0006.

In 20,000 parts, that's 20,000 × 0.0006 = 12 faults.

5. Arc & Chord Length

To calculate arc length, use: $L = 2\pi r(\theta/360)$.

Example explained:

Radius = 800 mm, angle = 30°. Substituting gives 419 mm.

Chord length uses trigonometry: $A = 2r \sin(\theta/2)$.

For 30°, sin(15°) = 0.259 → chord = 414 mm.

6. Ethics & Responsible Sourcing

Manufacturers must think about how their materials affect people and the planet.

Example explained:

• Social – Protect workers from unsafe conditions.

• Ethical – Avoid using exploited labour.

• Environmental – Reduce pollution and habitat destruction.

7. Electronics & Manufacturing

Surface-Mount Technology allows tiny components to be placed quickly on PCBs.

Example explained:

Machines place the parts automatically, and a reflow oven melts the solder to stick everything down.

Microcontrollers allow manufacturers to change features just by updating software instead of redesigning the whole circuit.

Design Engineering Revision Guide with Explained Example Answers

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