

Design & Technology (Product Design)

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OCR A-Level

Integrating Cross- Disciplinary Knowledge in Design (3.5a)

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

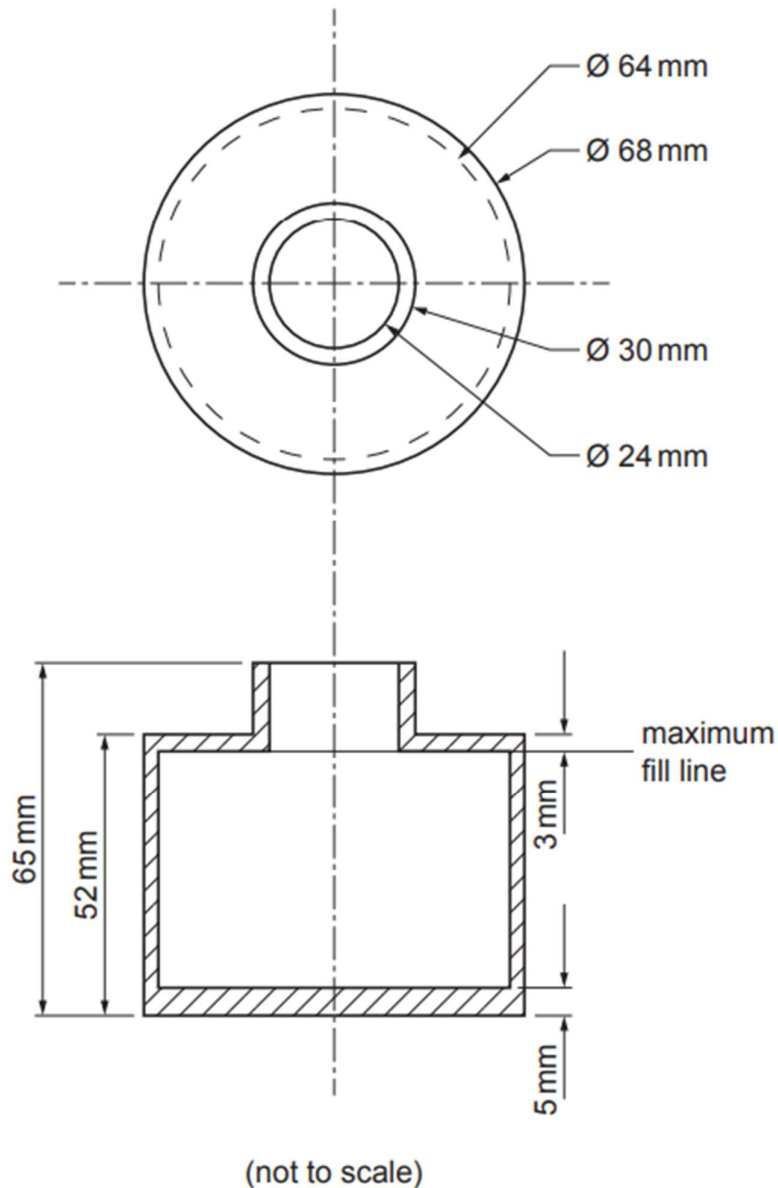
- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don't spend too much time on one question

Good luck!

Q1. The image below shows a diagram of the cylindrical glass bottle.



Q1a. Use the information from the diagram to calculate the volume of the bottle up to the maximum fill line. Give your answer to the nearest cm^3 and show your working. (4 marks)

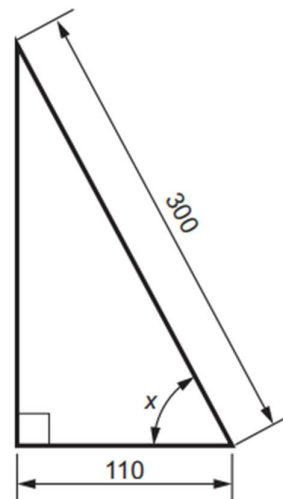
Q1b. The oil costs £10 per litre. For quantities over one litre the supplier will apply a 3% discount to the total cost. Complete the table below to show the cost of the oil at different quantities. **(2 marks)**

Quantity of Oil	Cost
1 litre	£10.00
2 litres	
3 litres	
4 litres	
5 litres	

Q1c. The oil is sold in 25 ml increments. Use your answer from part (b) to calculate how many increments of oil are needed to fill each bottle to the maximum fill line. Show your working. **(2 marks)**

$$1 \text{ ml} = 1 \text{ cm}^3$$

Q2. These images show the angle of the plate when the electric iron is safely stood up on a flat surface. All measurements are given in mm.



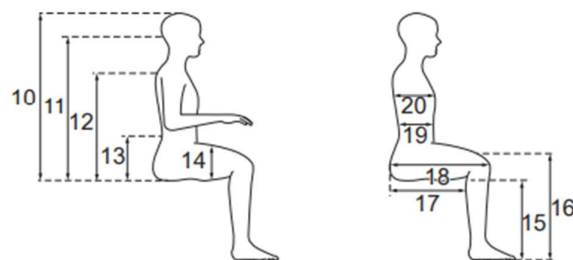
(not to scale)

Calculate angle x. Give your answer to the nearest degree and show your working. **(5 marks)**

Q3. During routine quality control checks of a new batch of irons a fault is identified. Of the 1500 irons tested the fault occurs 3 times. Calculate the probability of an iron having the identified fault. **(1 mark)**

Q4. The table below shows anthropometric data in a table and reference diagrams.

Dimensions (mm)	Age Range 5–9			Age Range 13–19			Age Range 19–65					
	Combined (Percentiles)			Combined (Percentiles)			Men (Percentiles)			Women (Percentiles)		
	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%
10 Sitting height	594	694	797	774	908	968	860	915	970	800	855	910
11 Sitting eye height	446	570	648	640	759	834	740	800	860	700	750	800
12 Sitting shoulder	315	390	440	520	575	635	570	615	660	530	580	630
13 Sitting elbow height	120	160	205	185	232	285	210	250	290	190	235	280
14 Thigh thickness	81	116	169	116	153	178	130	155	180	120	150	180
15 Popliteal height (lower leg length)	220	295	340	360	435	485	410	450	490	370	410	450
16 Knee height	315	393	481	456	525	558	490	535	580	460	495	530
17 Buttock-popliteal length	230	300	350	430	480	545	450	510	570	440	500	560
18 Buttock-knee length	321	410	511	490	571	628	560	605	670	520	585	650
19 Abdominal depth	140	165	195	185	215	270	220	275	330	200	270	340
20 Chest depth	125	140	170	210	230	265	210	245	280	210	250	290



The music stand will have an adjustable height and the sitting eye height of the users must be considered. Use the information above, identify the minimum

and maximum sitting eye height for 90% of both adults and children over 13. **(2 marks)**

Answers

Q1a.

- Volume of a cylinder = $\pi r^2 h$ [1]
- 32mm = 3.2 cm radius of circle and 44mm = 4.4 cm (height of cylinder reducing glass e.g. 52 – 5 – 3) [1]
- $\pi \times 3.2^2 \times 4.4 = \pi \times 10.24 \times 4.4 = \pi \times 45.06 = 141.5475986 \text{ cm}^3$ [1]
- $\approx 142 \text{ cm}^3$ [1]

Accept 141.566 as non-rounded for 3 marks as this is from π as 3.142 The candidate may have used a different route using $V = C \times r \times h$ then followed through with integration (calculus) to achieve the answer; award credit if this process is **used**.

Q1b.

Quantity of Oil	Cost
1 litre	£10.00
2 litres	£19.40
3 litres	£29.10
4 litres	£38.80
5 litres	£48.50

Q1c.

- $142 \text{ cm}^3 = 142 \text{ ml}$ $142 / 25 = 5.68$ [1]
- (portions of 25ml), has to be complete 25ml increments and therefore the answer would be 6 [1]

Answers need to be rounded up to work out oil increments

Q2.

- $\cos^{-1}(x) : \text{Adj/Hyp}$ (1) (1)
- $\cos^{-1}(x) = 110/300 = 0.3666666666$ r (1)
- $x = \cos^{-1}(0.3666666666) = 68.48981173$ (1)
- $x = 68^\circ$ (1)

4 marks if answer is 69°

4 marks if answer is 68.5°

Q3.

Fault occurring $3/1500 = 0.002$ or $1/500$ (1)

Q4.

90% has to be 5% for children age 13, 95% for males

Minimum = 640 mm (1)

Maximum = 860 mm (1)