

INDIUM CORPORATION



SMTA Certification Prep Quiz



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Name: _____

Closed Book Test—You must answer these questions without any resources.

1. In SAC305 (1 point each)
 - a. What does the “S” stand for? _____
 - b. What % of this metal is in SAC305? _____
 - c. What does the “A” stand for? _____
 - d. What % of this metal is in SAC305? _____
 - e. What does the “C” stand for? _____
 - f. What % of this metal is in SAC305? _____
2. Which one of the statements below is false? (5 points)
 - a. A chip shooter can place passives at 20,000/hr. _____
 - b. A typical solder powder diameter is 25 microns. _____
 - c. A PQFP has a lead spacing of 0.4mils. _____
 - d. HASL = Hot air solder level. _____
3. Which one of the statements below is true? (5 points)
 - a. A chip shooter can place complex integrated circuits. _____
 - b. Reflow ovens need the PWB to have a fiducial for alignment. _____
 - c. A chip shooter places with an accuracy of 5 microns. _____
 - d. Solder paste is about 90% by weight metal. _____
4. A stencil is 5mils thick. An aperture is 6.5mils wide. Is the aspect ratio acceptable? (5 points) _____
5. What is response-to-pause? (4 points) _____

6. A 5-step process has 95% yield at each step. What is the end of the line yield? (5 points) _____
7. True or false: A non-clean solder paste leaves no residue. (5 points) _____
8. What is the approximate melting point of SAC305? (5 points) _____
9. True or false: Modern solder alloys are so well designed that wave soldering machines no longer need flux. (5 points) _____
10. What is the five ball rule? (5 points) _____

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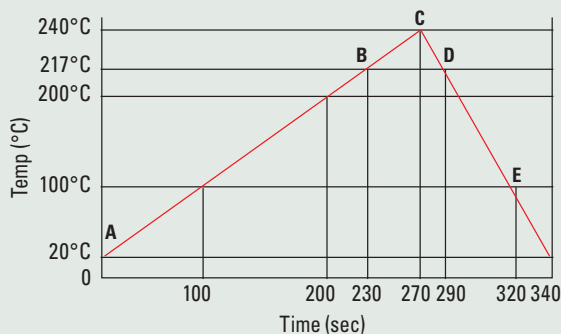
Open Book Test—You may use Excel, a calculator, and the SMT 101 Insider Series Handout. You may not use canned software.

I. An SMT assembly line consists of a stencil printer, a chip shooter, a flexible placer, and a reflow oven. The line needs to produce 200,000 assembled boards per year. The printer has an uptime of 90%, each placement machine is up 85% and the reflow oven is up 95%. The bill of material (BOM) is 412 passives, 28 simple integrated circuits (SICs), and 6 complex integrated circuits (CICs). The chip shooter places passives at 60,000/hr. and SICs at 4,000/hr. The flexible placer places CICs at 4,000/hr. and SICs and passives at 8,000/hr. The board needs to be in the 312cm reflow oven for 4 minutes. The PWB is 24cm long. Assume 98% yield.

Management hopes to produce all 200,000 PCBs with one 5-day-a-week, 8-hour shift. The factory is closed for two weeks per year.

1. How many hours per year is the assembly line available if all machines had 100% uptime? (5 points) _____
2. How many hours of production per year are there considering the stated uptimes? (5 points) _____
3. What cycle time is needed to produce the 200,000 boards? (5 points) _____
4. Assume that the “gate” in the assembly process is component placement. Time balance the placement machines. Can the needed cycle time be supported? (15 points) _____
5. Can the reflow oven support the needed cycle time? (10 points) _____
6. If the 200,000 assembled boards goal is not achieved, could they be built if overtime was employed? If so, how much overtime per day? (10 points) _____

II. A reflow oven profile, as shown below, needs to be matched to the solder paste specification, also below. Is the reflow profile acceptable? (20 points) _____



Reflow Profile Details	SAC305 Parameters	
	Recommended	Acceptable
Ramp Profile (Average Ambient to Peak)— Not the Same as Maximum Rising Slope	0.5–1°C/second	0.5–2.5°C/ second
Soak Zone Profile (Optional)	30–90 seconds	30–120 seconds
	160–180°C	150–200°C
Time Above Liquidus (TAL)	45–60 seconds	30–100 seconds
Peak Temperature	230–260°C	230–262°C
Cooling Ramp Rate	2–6°C/second	0.5–6°C/second
Reflow Atmosphere	Air or N ₂	

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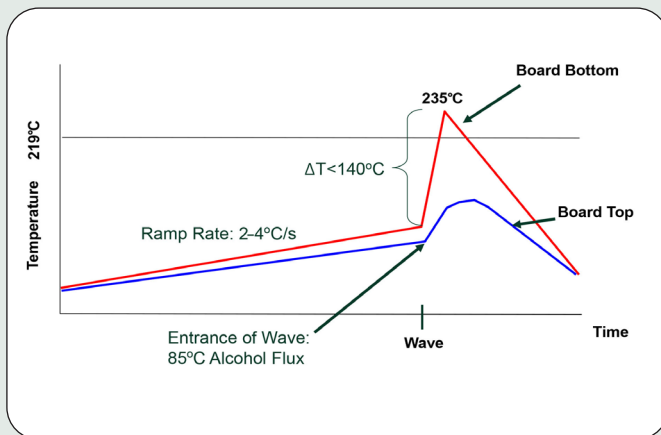
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III. A 6mil thick stencil is to be designed for 0.4mm PQFPs and a 30mil BGA. A Type 3 solder paste is to be used. The stencil apertures should be 2mils narrower than the PWB pads. Using reasonable assumptions, and the five ball rule, aspect and area ratios, discuss any concerns or issues. (20 points)

IV. A lead-free wave solder preheat profile from a thermal profiler is shown below for the board bottom and top temperatures. The solder has not been chemically analyzed in 12 months. What concerns do you see? What type of defects might occur? (20 points)



Interested in learning more about your results? Contact our SMTA Certification expert and **Senior Technologist Dr. Ron Lasky** at rlasky@indium.com. Find more information on the SMTA Certification program at <https://smta.org/page/certification>.

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