RELEVANT TO FOUNDATION LEVEL PAPER MA1

Process costing

Process costing is an important topic in the study for Papers MA1 and MA2 with objective test questions on the topic being part of every exam for each paper. Performance to date has been disappointing almost regardless of which aspect of process costing is examined.

There are three main areas within the topic of process costing:
1. Accounting for incomplete work at the end of a period.
2. Dealing with normal and abnormal losses and gains.
3. Accounting for joint products.

The first of the above areas is covered by the *Study Guide* for Paper MA1 and will be the subject of this article. The remaining two areas are covered by the *Study Guide* for Paper MA2 and will be the subject of two subsequent articles.

Accounting for incomplete work
The main feature of a manufacturing process (as applied in the topic of process costing) is that it is continuous. Industry examples include oil refining and chemical processing. At any point in time there will be incomplete work in a process. This will apply to the conversion costs (direct labour and production overheads) and may also apply to direct materials (depending upon the stage(s) of the process at which the materials are input).

Incomplete work needs to be accounted for at the end of each period so that the costs charged against the completed output are accurate and a value is placed on the incomplete work.

NB In practice, if there is closing work-in-progress then there will also be opening work-in-progress. However, multiple-choice questions in Paper MA1 exams will always assume, for simplicity, that there is no opening work-in-progress.

Equivalent units
Equivalent units are notional whole units that are equivalent to the number of incomplete units adjusted for their stage of completion. For example, if there are 200 incomplete units in a process at the end of a period and they are 75% complete then this is equivalent to 150 (200 × 0.75) whole (complete) units.

Stages in accounting
Accounting for incomplete work, in process costing, involves three stages:
Stage 1: calculation of equivalent units;

Stage 2: calculation of costs per equivalent unit;
Stage 3: valuation of completed output and work-in-progress.

Stage 1: calculation of equivalent units
As explained and illustrated above, the calculation of equivalent units in process costing depends upon two factors:
- the number of units of production that are incomplete in a process at the end of a period
- the stage of completion of the incomplete work in respect of conversion costs and direct materials.

Example multiple-choice question (MCQ)
A typical example of an MCQ requiring the calculation of equivalent units in Paper MA1 is:
A manufacturing process had no work-in-progress at the start of a period and no losses during the period. 3,200 units of raw material were input to the process during the period. 2,800 units were completed in the period. Closing work-in-progress was 100% complete with respect to materials and 70% complete with respect to conversion costs.

What were the equivalent units of production in the period?

	Materials	*Conversion costs*
A	*3,200*	*960*
B	*2,800*	*280*
C	*3,200*	*3,080*
D	*2,800*	*120*

Correct answer
The equivalent units of production, for both materials and conversion costs, must be at least 2,800 units because that is the amount of the completed output. The correct answer must, therefore, be Option C because that is the only option with more than 2,800 units for the conversion costs.
In a similar MCQ, in the December 2011 Paper MA1 exam, only 36% of candidates chose the correct answer.

Alternatively:
Materials: as there are no losses in the process and the work-in-progress is 100% complete for materials then the production units in respect of materials must be the input of 3,200 units. This eliminates Options B and D.
Conversion costs: the equivalent units are the output of 2,800 units plus the 400 units of closing work-in-progress (3,200 units input less 2,800 units output) multiplied by 70% (the stage of completion). Thus 2,800 + (400 × 0.7) = 3,080 (Option C).

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Incorrect answers
For conversion costs the other three answer options (960, 280, 120) were based on:

Option A: 30% of the whole of the input (3,200 × 0.3), thus ignoring the fact that 2,800 units were completed and the closing work-in-progress was 70% (not 30%) complete. This option was chosen (incorrectly) by nearly one third of candidates in the similar MCQ in the Paper MA1 exam.

Option B: 70% of the closing work-in-progress (400 × 0.7). This again ignores the 2,800 units completed. This would have been the correct answer for conversion costs if the MCQ has asked for the equivalent units of closing work-in-progress only, rather than the equivalent units of production. However, in any case, the production units for materials were also incorrect. Nearly one third of candidates chose (incorrectly) this option.

Option D: 30% of the closing work-in-progress (400 × 0.3). This also ignores the completed units and is the incorrect stage of completeness for the work-in-progress (using % incomplete rather than % complete). This option also does not have the correct units for materials. Relatively few candidates chose this option.

Other MCQs
Other MCQs requiring the calculation of equivalent units that may be expected in Paper MA1 include:
  • calculation of the equivalent units of work-in-progress only. Using the illustration above the answer would be 400 units for materials (3,200 – 2,800) and 280 units for conversion costs [(3,200 – 2,800) × 0.7].
  • calculation of equivalent units for conversion costs only. If production units are required this would be 3,080 equivalent units and if closing work-in-progress is required this would be 280 equivalent units.
  • Raw materials added in stages during a process with the result that the work-in-progress is incomplete for materials as well as for conversion costs. For example, in the above illustration, if the materials in the closing work-in-progress had been 80% complete then the equivalent units of production for materials would have been 3,120 units [2,800 + (400 × 0.8)] with 320 equivalent units in closing work-in-progress.

Stage 2 – calculation of costs per equivalent unit
Having calculated the equivalent units of production, the next stage is to calculate the production costs per equivalent unit by dividing the input costs by the number of equivalent units of production. This will need to be calculated separately for each of materials and conversion costs if the number of equivalent units are different, which will invariably be the case. However, because of the work involved with the calculation of materials as well as

conversion costs, MCQs in the exam are likely to require the calculation of one or the other only.

Example MCQ

A typical example of an MCQ requiring the calculation of production costs per equivalent unit in Paper MA1 is:

A manufacturing process had no work-in-progress at the start of a period and no losses during the period. Completed output was 85,000 kg in the period during which 105,000 kg of material were input to the process. The closing work-in-progress was 60% complete. Conversion costs totalled $592,000 in the period.

What was the conversion cost per equivalent unit (to two decimal places)?
A $5.64
B $6.10
C $6.37
D $6.96

Correct answer

Like the MCQ used earlier to illustrate Stage 1, the equivalent units of conversion costs have to be calculated. Thus both Stages 1 and 2 have to be gone through. This would be typical of MCQs requiring the calculation of costs per equivalent unit.

As there are no losses in the process the closing work-in-progress is 20,000 kg (105,000 – 85,000). The equivalent (whole) units of closing work-in-progress for conversion costs are 12,000 kg (20,000 × 0.6) and the total equivalent units of production are 97,000 kg (85,000 + 12,000).
The conversion cost per equivalent unit is $592,000 ÷ 97,000 kg = $6.10 (Option B).

In a similar MCQ, in the December 2011 Paper MA1 exam, only 38% of candidates chose the correct answer.

Incorrect answers

Options A and D: Option A divides the total conversion costs by the total input ($592,000 ÷ 105,000 kg = $5.64). The unit cost in this instance is too low because it assumes that all of the input has become completed output. Option D divides the total conversion costs by the completed output ($592,000 ÷ 85,000 kg = $6.96). The unit cost in this instance is too high because it ignores the closing work-in-progress.

15% of candidates incorrectly chose Option A and 30% Option D in the similar MCQ in the Paper MA1 exam.

Option C: this option assumes that 40% (the degree of incompleteness) rather than 60% (the degree of completeness) should be used to calculate the equivalent units of closing work-in-progress. Thus $592,000 ÷ [85,000 + (20,000 × 0.4)] = $6.37.
Over 15% of candidates incorrectly chose this option.

Other example MCQs
Other MCQs requiring the calculation of production costs per equivalent unit that may be expected in Paper MA1 exams include:
- materials only: if all materials are input at the start of the process and there are no losses then equivalent units of production = input.
- materials added in stages: equivalent units depend upon the stage of completion of the closing work-in-progress.

Stage 3 – valuation of completed output and closing work-in-progress
Having calculated the production costs per equivalent unit, the final stage in the accounting for incomplete work is to place a value on each of:
- completed output
- closing work-in-progress.

This requires the multiplication of the equivalent units by the cost per unit for each of materials and conversion costs. It is likely that any MCQ in a Paper MA1 exam will also require the calculation of the equivalent units (Stage 1) but will provide details of the costs per unit (Stage 2).

Example MCQs
A typical example of an MCQ requiring the valuation of output and closing work-in-progress in Paper MA1 is:
Completed output from a process in a period was 16,000 units. There was no opening work-in-progress but 1,200 units, which were complete for materials but only 40% processed in respect of conversion costs, were unfinished at the end of the period.

The costs per equivalent unit for the period were:
Materials $12.60
Conversion costs $8.70

What was the value of the closing work-in-progress?
A $25,560
B $10,224
C $19,296
D $21,384

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Correct answer
Once again, the relevant equivalent units have to be calculated. The units of completed output can be ignored because:
- the MCQ is about the valuation of the closing work-in-progress only
- the units of closing work-in-progress are given in the question
- the costs per unit are given in the question.

The equivalent (whole) units of closing work-in-progress are:
Materials   1,200
Conversion costs   480 (1,200 × 0.4).

To calculate the value of the closing work-in-progress, the respective equivalent units for materials and conversion costs are multiplied by the costs per unit given in the question. Thus:
Materials $15,120 (1,200 units × $12.60/unit)
Conversion costs $4,176 (480 units × $8.70/unit)
                   $19,296 (Option C)

Incorrect answers
Option A: this answer multiplies the 1,200 units of closing work-in-process by the total unit cost [1,200 × (12.60 + 8.70) = 25,560] as if the incomplete units were complete. This overstates the work-in-progress value.

Option B: this answer multiplies the equivalent units of closing work-in-progress by the total unit cost [480 × (12.60 + 8.70) = 10,224] as if both the materials and the conversion costs were only 40% complete. This understates the work-in-progress value.

Option D: this answer incorrectly uses the incompleteness (60%) rather than the completeness (40%) of the closing work-in-progress in respect of the conversion costs. Thus:
Materials $15,120
Conversion costs $6,264 (1,200 units × 0.6 × $8.70/unit)
                   $21,384

Other example MCQs
Other MCQs requiring the valuation of completed output and closing work-in-progress that may be expected in Paper MA1 exams, include:
- valuation of the completed output. Using the data from the above example, the answer to that question would be $340,800 (16,000 units × $21.30/unit)
- valuation of only the materials element or only the conversion cost element of the closing work-in-progress (using the above example this would be $15,120 or $4,176).

Summary
Process costing is a topic that will always be examined in Paper MA1. It is important that candidates are clear about the different stages in the accounting for incomplete work. It is hoped that this article has clearly explained each stage and illustrated the sorts of MCQs that will be in the exam.

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