# SOLUTIONS TO END-OF-CHAPTER QUESTIONS CHAPTER 11

## RECALL AND REVIEW

### Question 11.1

**(a)** £230 direct material + £45 direct labour + £18 other direct costs per unit = £293 prime cost per unit

£293 prime cost per unit × 1,500 units = £439,500 total prime cost

**(b)** £90,000 rent and rates ÷ 1,500 units of normal production = £60 overhead cost per unit

£293 prime cost per unit + £60 overhead cost per unit = £353 production cost per unit

£353 production cost per unit × 1,500 units of normal production = £529,500 total production cost

**(c)** £353 production cost per unit × 1.20 = £423.60 selling price per unit

### Question 11.2

Absorption costing is simple and straightforward as it uses one single basis such as labour hours or machine hours to allocate overhead costs to products. However, as a consequence, it is not a very precise method of cost allocation as the same allocation basis is used for very different overhead costs and for very different products. Activity-based costing is a more complex approach to overhead allocation. Activity-based costing allocates costs to cost pools rather than to departments. Overheads in those cost pools are then allocated to products on the basis of the amount of activity (cost drivers) that each product consumes during the production process. The main advantage of activity-based costing is that it produces more precise cost information which in turn results in more informed decisions.

## DEVELOP YOUR UNDERSTANDING

### Question 11.3

**Absorption cost for one food processor**

| | £ |
|---|---|
| Materials: £22,500 ÷ 2,000 food processors | 11.25 |
| Direct labour: £16,500 ÷ 2,000 food processors | 8.25 |
| Direct expenses: £13,000 ÷ 2,000 food processors | 6.50 |
| Overhead allocation: 4.5 machine hours × £4 per hour* | 18.00 |
| **Total absorption cost of one food processor** | **44.00** |

*Overhead absorption rate: £3,000,000 ÷ 750,000 machine hours = £4 per machine hour

Selling price for one food processor: total absorption cost plus 50% = £44 × 1.5 = £66

### Question 11.4

**Printers Ltd print run**

| | £ |
|---|---|
| Paper: 2,000 books × 400 pages = 800,000 pages ÷ 2,500 pages × £9 per 2,500 pages | 2,880 |
| Printing ink: 800,000 pages ÷ 20,000 × £57.50 | 2,300 |
| Covers: 2,000 books × 66 pence per book | 1,320 |
| Finishing costs: 2,000 books × 50 pence | 1,000 |
| Production workers: 200 × £12.50 | 2,500 |
| Overheads: £500,000 ÷ 50,000,000 pages × 800,000 printed pages | 8,000 |
| **Total cost for print run of 2,000 books** | **18,000** |

Selling price for printing 2,000 books: £18,000 × 1.25 = £22,500 = £11.25 for each book (£22,500 ÷ 2,000)

### Question 11.5

| Input | (a) | (b) | £ |
|---|---|---|---|
| Fabric | £9.00 per shirt | Direct material | 9.00 |
| Thread and other direct materials | £0.30 per shirt | Direct material | 0.30 |
| Wages paid to sewing operators | £3.00 per shirt | Direct labour | 3.00 |
| Factory electricity and gas | £22,000 per annum | Indirect cost | 1.10 |
| Packaging materials | £0.20 per shirt | Direct material | 0.20 |
| Wages paid to packaging workers | £0.50 per shirt | Direct labour | 0.50 |
| Machinery repairs and maintenance | £20,000 per annum | Indirect cost | 1.00 |
| Factory rent | £50,000 per annum | Indirect cost | 2.50 |
| **Total cost of production per shirt** | | | **17.60** |

Overhead allocation:

- Factory electricity and gas: £22,000 overhead ÷ 20,000 shirts = £1.10 per shirt produced.
- Machinery repairs and maintenance: £20,000 overhead ÷ 20,000 shirts = £1.00 per shirt produced.
- Factory rent: £50,000 overhead ÷ 20,000 shirts = £2.50 per shirt produced.

## Question 11.6

**(a)** Total production cost for 20,000 shirts: £17.60 production cost per shirt × 20,000 shirts sold = £352,000.

**(b)** Profit on the sale of 20,000 shirts: (£20.00 selling price per shirt – £17.60 production cost per shirt) × 20,000 shirts sold = £48,000.

**(c)** Selling price to make a profit of £60,000: £60,000 ÷ 20,000 shirts = £3.00 per shirt. Therefore, the selling price per shirt to make a total profit of £60,000 is £17.60 (total production cost of one shirt) + £3.00 (profit on the sale of one shirt) = £20.60. Proof: 20,000 shirts × £20.60 – £352,000 total production cost = £60,000.

## Question 11.7

| | Production departments | | | Support departments | | |
|---|---|---|---|---|---|---|
| | Line 1 | Line 2 | Line 3 | IT | HR | Stores |
| | £ | £ | £ | £ | £ | £ |
| Costs | 183,000 | 349,000 | 155,000 | 80,000 | 52,000 | 56,000 |
| Usage of IT | 20,000 | 24,000 | 24,000 | (80,000) | 8,000 | 4,000 |
| Usage of HR | 12,000 | 24,000 | 15,000 | — | (60,000) | 9,000 |
| Usage of stores | 17,250 | 31,050 | 20,700 | — | — | (69,000) |
| **Total costs** | **232,250** | **428,050** | **214,700** | — | — | — |

## TAKE IT FURTHER

### Question 11.8

**Applokia Limited**

| Part (a) | Variable cost | Fixed cost | Direct production cost | Production overhead | Period cost |
|---|---|---|---|---|---|
| Factory rent | | ✓ | | ✓ | |
| Factory manager's salary | | ✓ | | ✓ | |
| Administration salaries | | ✓ | | | ✓ |
| Marketing costs | | ✓ | | | ✓ |
| Plastic smart phone covers | ✓ | | ✓ | | |
| Quality control salaries | | ✓ | | ✓ | |
| Production line salaries | | ✓ | ✓ | | |
| Chip assemblies | ✓ | | ✓ | | |
| Administration office rent | | ✓ | | | ✓ |
| Marketing office rent | | ✓ | | | ✓ |
| Factory rates | | ✓ | | ✓ | |
| Power for production machinery | ✓ | | ✓ | | |
| Factory lighting and heating | | ✓ | | ✓ | |
| Administration lighting and heating | | ✓ | | | ✓ |
| Marketing lighting and heating | | ✓ | | | ✓ |
| Marketing department salaries | | ✓ | | | ✓ |
| Batteries | ✓ | | ✓ | | |
| Machinery depreciation | | ✓ | | ✓ | |

Variable costs: these are the costs that will vary directly in line with production. If you were at all unsure about which costs would be variable in this case, the way to determine if a cost is variable is to ask yourself if more of that cost will be incurred if another smart phone, another unit of production, is produced. In Applokia's case, each additional smart phone will require a plastic cover, a chip assembly, a battery and additional power for the production machinery to produce another smart phone. Therefore, these costs of production are entirely variable as they will increase or decrease directly in line with production.

Assembly line workers are paid a salary so these remain the same no matter how many or how few smart phones are produced. Thus, the assembly line workers' salaries, while being a direct cost of production (there will be no production without their input), are fixed rather than variable.

All other costs are fixed. Rent and rates will not vary in line with production and anyone paid a salary will receive the same salary no matter how many smart phones are produced or sold. Lighting and heating is best treated as a fixed cost as we noted in the case of Anna (Example 11.4) as it is not possible to allocate these costs to individual units of production.

**Part (b)**

| | £000 |
|---|---|
| Prime cost | |
| Plastic smart phone covers | 250 |
| Chip assemblies for smart phones produced | 1,498 |
| Batteries | 242 |
| Production line workers' salaries | 500 |
| Power for production machinery | 50 |
| **Total prime cost** | **2,540** |
| **Production overhead** | |
| Factory rent | 100 |
| Factory manager's salary | 38 |
| Factory rates | 47 |
| Production machinery depreciation | 37 |
| Factory lighting and heating | 43 |
| Quality control salaries | 75 |
| **Total production overhead** | **340** |
| **Total production cost (total prime cost + total production overhead)** | **2,880** |
| **Period costs** | |
| Administration salaries | 85 |
| Administration office rent | 25 |
| Administration lighting and heating | 5 |
| Marketing lighting and heating | 4 |
| Marketing department salaries | 51 |
| Marketing office rent | 20 |
| Marketing costs | 50 |
| **Total period costs** | **240** |
| **Total costs for September** | **3,120** |

**Part (c)**

Total costs from part (b): £3,120,000

Total production in September from the question: 130,000 smart phones

Total cost of one smart phone in September: £3,120,000 ÷ 130,000 = £24

Selling price = cost + 25% = £24 + (£24 × 0.25) = £30

**Part (d)**

If Applokia sells its smart phones for £27, it will make a profit on total cost of £27 – £24 = £3. This is equivalent to a margin on cost of £3 ÷ £24 × 100% = 12.50%. Proof that this is the correct answer: £24 + (£24 × 0.125) = £27

## »» Question 11.9

**Part (a) Total production overheads to be allocated to the manufacturing and painting and finishing departments**

The first task is to determine appropriate allocation bases for overheads. Using the information from the question, the following overhead bases would be the most suitable for each overhead:

- Machinery maintenance staff salaries and painting and finishing department employee salaries: actual cost for each department.
- Employers' national insurance contributions: these should be allocated on the basis of the salary costs in the two departments as higher salaries will mean higher employers' national insurance costs. Total salaries are £100,000 + £300,000 = £400,000. The manufacturing department is thus allocated (£100,000 ÷ £400,000) × £40,000 = £10,000 and the painting and finishing department is allocated (£300,000 ÷ £400,000) × £40,000 = £30,000.
- Rent and rates should be allocated on the basis of area as the bigger the area occupied by each department, the higher the allocated costs. Total area is 4,800 square metres + 1,200 square metres = 6,000 square metres. Total costs are £60,000, so the manufacturing department is allocated (4,800 ÷ 6,000) × £60,000 = £48,000 and the painting and finishing department is allocated (4,800 ÷ 6,000) × £60,000 = £12,000.
- Heating should be allocated on the basis of actual usage. The manufacturing department is not heated; there is not much point keeping machinery warm! As heat will be generated by the machinery as it is running to keep the manufacturing department heated, all the heating costs should be allocated to the painting and finishing department.
- Lighting is most appropriately allocated on the basis of area. Total costs are £25,000, so the manufacturing department is allocated (4,800 ÷ 6,000) × £25,000 = £20,000 and the painting and finishing department is allocated (4,800 ÷ 6,000) × £25,000 = £5,000.
- Machinery depreciation is best allocated on the basis of machinery value. Total machinery value is £360,000 + £15,000 = £375,000, so the manufacturing department is allocated (£360,000 ÷ £375,000) × £75,000 = £72,000 and the painting and finishing department is allocated (£15,000 ÷ £375,000) × £75,000 = £3,000.
- Canteen expenses should be allocated on the basis of the number of employees. The total number of employees is five in manufacturing plus 15 in painting and finishing, a total of 20 employees. Manufacturing department is allocated (5 ÷ 20) × £56,000 = £14,000 and the painting and finishing department is allocated (5 ÷ 20) × £56,000 = £42,000.
- Electricity for machinery should be allocated on the basis of the number of hours usage during the year as the number of hours of running time will determine the power that is used by that machinery. The total number of machine hours for the year is 96,000 in manufacturing and 4,000 in painting and finishing, a total of 100,000 hours. The manufacturing department is thus allocated (96,000 ÷ 100,000) × £50,000 = £48,000 and the painting and finishing department is allocated (96,000 ÷ 100,000) × £50,000 = £2,000.

- Machinery insurance should also be allocated on the basis of machinery value. Given that the total machinery value is £375,000, the manufacturing department is allocated (£360,000 ÷ £375,000) × £25,000 = £24,000 and the painting and finishing department is allocated (£15,000 ÷ £375,000) × £25,000 = £1,000.

The overheads allocated to each department can be summarised in a table along with the allocation bases used.

| | Absorption basis | Total £000 | Manufacturing £000 | Finishing £000 |
|---|---|---|---|---|
| Salaries | Actual cost | 400 | 100 | 300 |
| Employers' national insurance | Salaries | 40 | 10 | 30 |
| Rent and rates | Area | 60 | 48 | 12 |
| Heating | Actual usage | 25 | — | 25 |
| Lighting | Area | 25 | 20 | 5 |
| Machinery depreciation | Machinery value | 75 | 72 | 3 |
| Canteen expenses | Number of employees | 56 | 14 | 42 |
| Electricity for machinery | Machinery hours | 50 | 48 | 2 |
| Insurance: machinery | Machinery value | 25 | 24 | 1 |
| **Total production overheads allocated to each department** | | **756** | **336** | **420** |

**Part (b) Most appropriate overhead recovery/absorption rate for the manufacturing and painting and finishing departments and justification for choice**

- Manufacturing has a high number of machine hours and a low number of labour hours, so the most appropriate basis for the absorption of overheads in the manufacturing department will be machine hours.
- This will give an absorption rate of £336,000 ÷ 96,000 hours = £3.50 per machine hour.
- Painting and finishing has a high number of labour hours and a low number of machine hours, so the most suitable basis for the absorption of overheads in the painting and finishing department is labour hours.
- This will give an absorption rate of £420,000 ÷ 80,000 hours = £5.25 per labour hour.
- Overheads should be absorbed on bases that provide the best approximation of actual costs incurred and spread the costs over as much activity as possible. Thus, where an activity is machine intensive, overheads will be absorbed by products on the basis of machine hours consumed in that activity. On the other hand, where an activity is labour intensive, overheads will be absorbed based on the labour hours used by that activity.

**Part (c) The cost of the novelty Christmas pixies will be:**

| **Novelty Christmas pixies: 5,000 units** | **£** |
|---|---|
| Direct materials and packaging | 10,000 |
| Direct labour | 1,000 |
| Manufacturing department 500 hours at £3.50 | 1,750 |
| Painting and finishing department 1,000 hours at £5.25 | 5,250 |
| Total cost | **18,000** |
| Cost per novelty Christmas pixie £18,000 ÷ 5,000 | **3.60** |

## »» Question 11.10

Step 1: reallocate service department overheads to production departments. The servicing department overheads can be allocated using the percentage of usage of the service department.

The canteen costs should be allocated on the basis of the number of employees using the canteen as follows:

- Total employees using the canteen: 15 + 5 + 6 + 4 = 30 (canteen employees do not use the canteen so no canteen overheads can be allocated to the canteen)
- Welding department's allocation of canteen overheads: 15/30 × £60,000 = £30,000
- Painting department's allocation of canteen overheads: 5/30 × £60,000 = £10,000
- Finishing department's allocation of canteen overheads: 6/30 × £60,000 = £12,000
- Service department's allocation of canteen overheads: 4/30 × £60,000 = £8,000

Service department costs are allocated on the basis of percentage usage by welding, painting and finishing:

- Service department overhead costs are now £42,000 (given in the question) + £8,000 overhead costs allocated from the canteen = £50,000
- Welding department's allocation of service department overheads: £50,000 × 40% = £20,000
- Painting and finishing departments' allocation of service department overheads: £50,000 × 30% = £15,000 each

| | **Welding** **£** | **Painting** **£** | **Finishing** **£** | **Canteen** **£** | **Service** **£** |
|---|---|---|---|---|---|
| Overheads from question | 100,000 | 75,000 | 43,000 | 60,000 | 42,000 |
| Canteen overheads reallocated | 30,000 | 10,000 | 12,000 | (60,000) | 8,000 |
| Service overheads reallocated | 20,000 | 15,000 | 15,000 | — | (50,000) |
| **Total overheads allocated** | **150,000** | **100,000** | **70,000** | — | — |
| Department labour hours | 30,000 | 12,500 | 10,000 | | |
| **Overhead absorption rate/hour** | **5.00** | **8.00** | **7.00** | | |

Step 2: calculate overhead absorption rates per hour for welding, painting and finishing:

- Welding department overhead absorption rate per hour: £150,000 (total overheads) ÷ 30,000 (total hours) = £5.00 per hour
- Painting department overhead absorption rate per hour: £100,000 (total overheads) ÷ 12,500 (total hours) = £8.00 per hour
- Finishing department overhead absorption rate per hour: £70,000 (total overheads) ÷ 10,000 (total hours) = £7.00 per hour

Step 3: calculate the cost of job 12359 using the information in the question and the overhead absorption rates calculated above.

| Job 12359 cost card | £ |
|---|---|
| Direct materials | 1,500 |
| Direct labour | 2,000 |
| Direct expense | 500 |
| Prime cost | 4,000 |
| Overhead: welding department: 120 hours × £5/hour | 600 |
| Overhead: painting department: 50 hours × £8/hour | 400 |
| Overhead: finishing department: 25 hours × £7/hour | 175 |
| **Production cost** | **5,175** |
| **Selling price: cost + 40% of cost: £5,175 + (£5,175 × 40%)** | **7,245** |

## »» Question 11.11

**Playthings Limited**

**Part (a)**

First, calculate the overhead to be allocated to each product:

i. Total machine hours: 10,000 for standard + 5,000 for deluxe = 15,000 hours in total

ii. Total overheads: £150,000

iii. Absorption rate of overheads per hour: £150,000 ÷ 15,000 hours = £10 per hour

iv. Machine hours per standard dolls house: 10,000 total hours ÷ 2,500 dolls houses produced = 4 hours per standard dolls house

v. Overhead allocated to each standard dolls house: 4 hours × £10 per hour = £40

vi. Machine hours per deluxe dolls house: 5,000 total hours ÷ 1,000 dolls houses produced = 5 hours per deluxe dolls house

vii. Overhead allocated to each deluxe dolls house: 5 hours × £10 per hour = £50

Total absorption cost and selling price for standard and deluxe dolls houses:

| | Standard | Deluxe |
|---|---|---|
| | £ | £ |
| Direct materials | 50 | 76 |
| Direct labour | 30 | 42 |
| Overheads absorbed | 40 | 50 |
| **Total cost** | **120** | **168** |
| **Selling price (cost + 50%)** | **180** | **252** |

**Part (b)**

Suitable cost drivers for the four overhead cost pools:

- Machining: machine hours would be the most suitable basis for the allocation of these overheads. The allocation rate will be £45,000 ÷ 15,000 hours = £3 per hour. Machining overheads of 10,000 × £3 = £30,000 will be driven by standard and 5,000 × £3 = £15,000 by deluxe dolls houses.
- The factory supervisor costs will be driven by the number of employees supervised: the more employees supervised, the more cost is generated by this cost driver. The allocation rate will be £30,000 ÷ 15 employees = £2,000 per employee. Supervisor costs of 5 × £2,000 = £10,000 will be driven by standard and 10 × £2,000 = £20,000 by deluxe dolls houses.
- Set up-related overheads will be driven by the number of set ups: the more set ups there are, the more the overhead incurred in this cost pool. The allocation rate will be £50,000 ÷ 50 set ups = £1,000 per set up. Set up overheads of 15 × £1,000 = £15,000 will be driven by standard and 35 × £1,000 = £35,000 by deluxe dolls houses.
- Purchasing department costs will be driven by the number of materials orders: the more materials orders there are, the more overhead will be incurred in this cost pool. The allocation rate will be £25,000 ÷ 1,000 materials orders = £25 per order. Purchasing costs of 400 × £25 = £10,000 will be driven by standard and 600 × £25 = £15,000 by deluxe dolls houses.

Overheads allocated to each product on an activity-based costing approach:

| | Standard | Deluxe |
|---|---|---|
| | £ | £ |
| Machining | 30,000 | 15,000 |
| Factory supervisor | 10,000 | 20,000 |
| Set up | 15,000 | 35,000 |
| Purchasing department | 10,000 | 15,000 |
| **Total overheads allocated** | **65,000** | **85,000** |
| Total production | **2,500** | **1,000** |
| Overhead per unit of production | **26** | **85** |

**Part (c)**

Total activity-based cost and selling price for standard and deluxe dolls houses.

| | Standard | Deluxe |
|---|---|---|
| | £ | £ |
| Direct materials | 50 | 76 |
| Direct labour | 30 | 42 |
| Overheads absorbed | 26 | 85 |
| **Total cost** | **106** | **203** |
| Selling price (cost + 50%) | **159** | **304.50** |

**Part (d)**

Advice to the directors on how they might reduce the cost of deluxe dolls houses in order to compete effectively in the market:

- Under traditional absorption costing, deluxe dolls houses are not being allocated their full share of overheads and so are subsidised by standard dolls houses.
- Activity-based costing now shows a much more accurate cost for each model of dolls house based on the costs incurred by the activities associated with each product.
- Under activity-based costing, standard dolls houses can now be sold at a much more competitive price (£159 v. the market price of £165) than under traditional absorption costing.
- An activity-based costing approach highlights activities that are causing cost with a view to helping management reduce costs in each particular cost pool, thereby reducing the costs of products in total.
- Machining costs are a necessary part of the manufacturing process and so it is unlikely that any reduction in these costs would be possible or desirable if quality is not to be compromised.
- The role of the factory supervisor could be looked at to determine whether this role is necessary. Employees could be given responsibility for their own production and quality control and incentives given to achieve zero defect production. However, any additional incentives would have to be considered in the total price of each product.
- The number of set ups in the year could be reduced to reduce total costs in this pool and in the amounts allocated to each product.
- Similarly, reducing the number of materials orders would reduce total costs in this pool and in the amounts allocated to each product.