

## Level 3 Cambridge Technical Extended Diploma in Engineering

05873

### Unit 24: Project management for engineers

Sample Assessment Material

**Date - Morning/Afternoon**

**Time allowed: 2 hours**

You may have:

- a calculator

First Name						Last Name					
Centre Number						Candidate Number					
Date of Birth											

#### INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number, candidate number and date of birth.
- Answer **all** the questions.
- Write your answer to each question in the space provided. Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).

#### INFORMATION

- The total mark for this paper is **80**.
- The marks for each question are shown in brackets [ ].
- This document consists of **15** pages. Any blank pages are indicated.

Answer **all** questions.

### **Collins Machined Components Ltd**

#### **Text 1**

Collins Machined Components Ltd is an engineering company based in the West Midlands. It manufactures machined parts for the automotive industry. The company was formed in 1965 by Tony Collins. Tony, who is still the Managing Director, is supported by three other directors. Collins Machined Components Ltd currently employs 90 people, located at three sites across the county. The company specialises in the mass production of poppet valves, pistons, specialised nuts and bolts. Most of its output is produced on outdated lathes and milling machines.

Collins Machined Components Ltd's annual sales revenue has not increased since the year 2010. Net profit has declined every year since 2012. The company urgently needs to increase its sales revenue and profit margin to secure its future. Tony thinks that this can be best achieved by increasing the quantity and quality of its current output. The other three directors think that expanding the company's product range may be a better solution. In addition to mass producing car parts, they would like to investigate the possibility of producing custom-made bespoke components for a wide range of manufacturing industries.

To move the company forward, the directors decide to initiate a formal project. Ashley is assigned as project manager. Ashley is a skilled engineer who has worked for the company for eight years. Ashley has recently obtained a diploma in project management. His end of course review recorded that Ashley had excellent planning and information management skills, but had poor leadership skills and needed to improve his management of conflict. The management of this project will be his first since completing the course.

The four directors comprise the project board with Tony as the project sponsor.

The project team comprises 28 members:

- Ashley as project manager
- Two project team leaders (both are long-serving employees of Collins Machined Components Ltd)
- Two external consultants (each from a different company)
- 23 other project team members (employees of Collins Machined Components Ltd. Ashley has not worked with many of the project team members before, either because they are recent recruits or because they work at other sites).

1 Refer to Text 1.

(a) Ashley needs to produce a project proposal and feasibility study.

(i) State **two** project aims which Ashley should include in his project proposal.

1 .....

2 .....

[2]

(ii) Explain the purpose of a feasibility study.

.....  
.....  
.....  
.....

[2]

(b) Project objectives should be specific, measurable, agreed, realistic and time specific.

Explain **one** reason why the objectives that Ashley sets for the project should be realistic.

.....  
.....  
.....  
.....

[2]

Turn over



(e) Ashley's project team comprises 28 people. It includes himself as project manager, two project team leaders, 23 project team members and two external consultants.

(i) State **one** duty of a project team leader.

.....  
.....[1]

(ii) State **one** benefit to Ashley of having external consultants on the project team.

.....  
.....[1]

(iii) Describe **one** way Ashley could establish rapport with his project team.

.....  
.....  
.....  
.....[2]

(iv) Explain why Ashley is likely to need good communication skills to manage this project.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....[4]

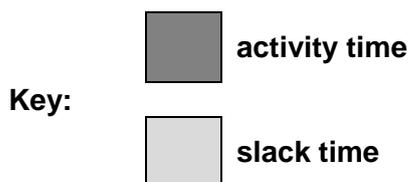
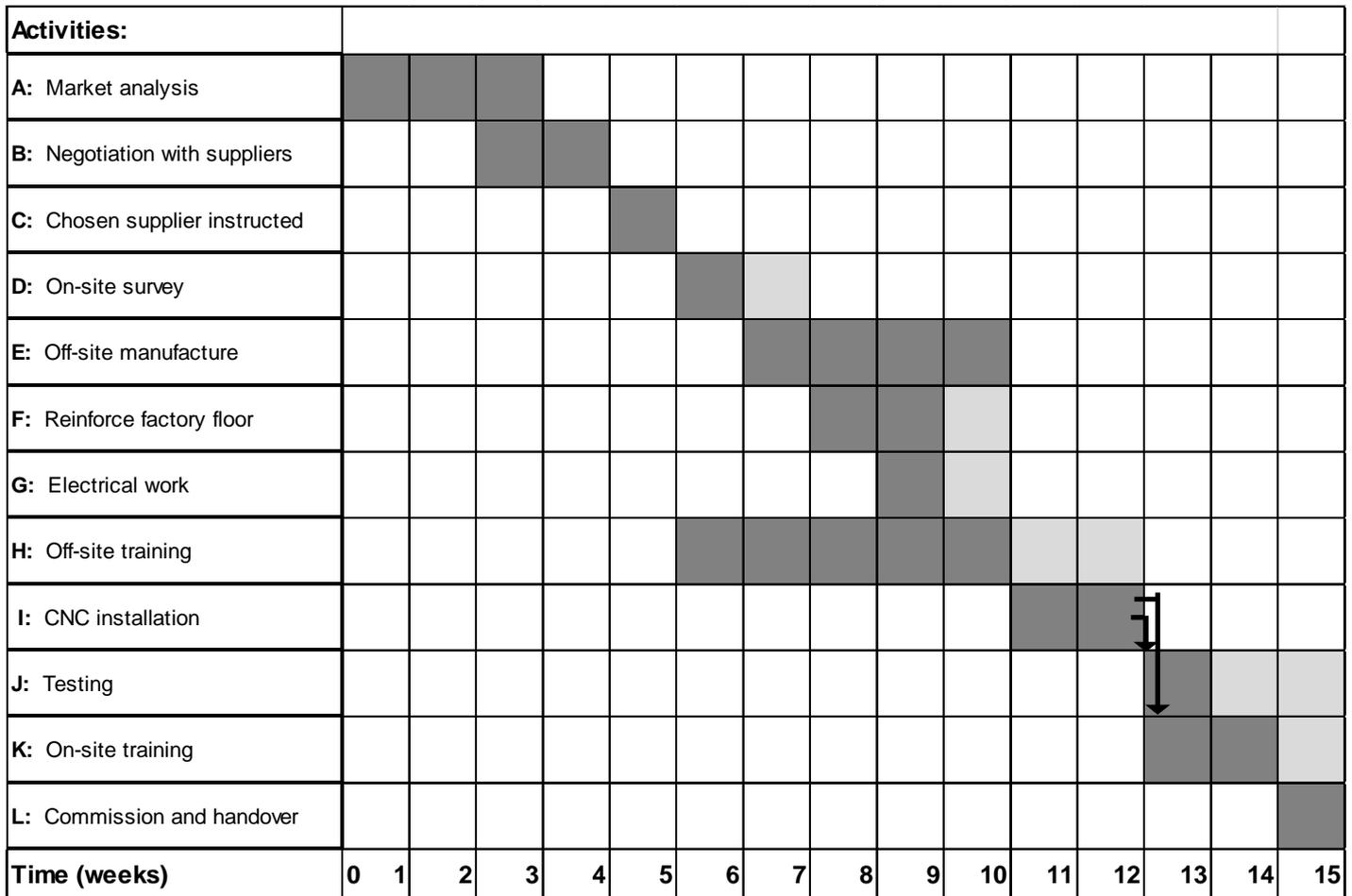
Turn over

## Text 2

After extensive research, Ashley recommends that Collins Machined Components Ltd should replace some of its outdated lathes and milling machines with modern CNC (Computer Numeric Control) machines. CNC machines would allow the company to increase the quantity and quality of its current output for the automotive industry and create the possibility of producing custom-made bespoke components for a wide range of other engineering sectors.

Four CNC machines would be required, each costing approximately £200 000. Ashley proposes that the cost of the four CNC machines should be financed using a 5-year secured variable rate bank loan, with a current APR of 3%.

A Gantt chart of activities required for Collins Machined Components Ltd to obtain the CNC machines is shown below.



**2 Refer to Text 2.**

**(a)** Ashley has proposed that the cost of the CNC machines should be funded by a bank loan.

Explain **one** advantage and **one** disadvantage to Collins Machined Components Ltd of using a bank loan to finance its CNC machines.

Advantage .....

.....

.....

.....

Disadvantage .....

.....

.....

.....

[4]

**(b)** Refer to Collins Machined Components Ltd's Gantt chart.

**(i)** Which activity has the longest duration?

.....[1]

**(ii)** How long should it take to complete Activity F: Reinforce factory floor?

.....[1]

**(iii)** Which activities are directly dependent on the completion of Activity I: CNC installation?

.....

.....[1]

**(iv)** Calculate the slack time for Activity J: Testing.

.....

.....[1]

**(v)** Which activity is concurrent with Activity K: On-site training?

.....

.....[1]

Turn over

(vi) If all goes to schedule, how long should the entire process from market analysis to handover take?

.....  
.....[1]

(vii) Ashley knows that on-site surveys are often subject to delay.

Calculate the shortest amount of time for the entire process from market analysis to handover if Activity D: On-site survey takes three weeks longer than expected.

.....  
.....  
.....  
.....[2]

(viii) Which activities are critical to Collins Machined Components Ltd obtaining handover of the CNC machines in the shortest possible time?

.....  
.....[1]

(c) Outline **two** human resource contingencies which Ashley should prepare for in the contingency plan for the CNC machines.

1 .....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....[4]













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**SPECIMEN**

**Sample Assessment Material**

**CAMBRIDGE TECHNICALS LEVEL 3 IN ENGINEERING**

**Unit 24 Project management for engineers**

**MARK SCHEME**

**Duration: 2 hours**

**MAXIMUM MARK 80**

**SPECIMEN**

**Version: 1 Date: 21/07/2016**

**This document consists of 14 pages**

Question			Answer	Marks	Guidance
1	(a)	(i)	<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• increase sales revenue</li> <li>• increase profit margin/profitability</li> <li>• increase profit</li> <li>• improve financial performance</li> <li>• secure company's future.</li> </ul>	2	One mark for each correct identification, to a maximum of two identifications.
1	(a)	(ii)	<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• analyse a proposed project</li> <li>• to assess costs of a proposed project</li> <li>• to assess the benefits of a proposed project</li> <li>• to justify going ahead with a proposed project</li> <li>• to determine if the project is viable</li> <li>• to determine if project should be followed through</li> <li>• to avoid wasting money from a failed project</li> <li>• to avoid wasting time from a failed project.</li> </ul> <p>Exemplar response: e.g. To check whether the costs and benefits (1) of a proposed project make it worthwhile going ahead (1).</p>	2	<p>Up to two marks for explanation.</p> <p>Do not award the word 'feasible'.</p>
1	(b)		<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• reasonable</li> <li>• attainable/possible/achievable</li> <li>• motivational</li> <li>• not de-motivating</li> </ul> <p>Exemplar responses: e.g. Objectives need to be realistic so that the other 27 members (CONT) of Ashley's team are motivated to successfully complete the project to deadline and within budget (2).</p>	2	<p>Up to two marks for explanation.</p> <p>Two marks for a contextual explanation. One mark for a non-contextual explanation.</p>

Question		Answer	Marks	Guidance
		e.g. The objectives need to be realistic so that the project management team believe that they have a genuine chance of reaching them. This will act as a motivational tool encouraging better performance (1).		
1	(c)	<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• keep informed</li> <li>• timely communication</li> <li>• specific communication</li> <li>• direct communication</li> <li>• avoid media speculation/grapevine gossip</li> <li>• not take up too much time</li> <li>• low spend.</li> </ul> <p>Exemplar response:</p> <p>e.g. A stakeholder with high interest but low power should be kept informed (1) of progress and key decisions made (1). This is best done by informing the organisation directly (1), rather than allowing them to find out through the media or from other contacts (1).</p>	4	One mark for each point of explanation to a maximum of four such points, but allow development.
1	(d)	<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• support the project sponsor (Tony)</li> <li>• provide collective direction for the project</li> <li>• may key decisions relating to timing and resources</li> <li>• commit resources e.g. physical, technological, human</li> <li>• commit to funding</li> <li>• demonstrating ownership for the project</li> <li>• facilitate cross functional working</li> <li>• ensure the project is recognised and respected by line management</li> </ul>	2	One mark for each correct identification, to a maximum of two identifications.

Question			Answer	Marks	Guidance
			<ul style="list-style-type: none"> <li>ensure that the project deliverables are reliable, sustainable and can be maintained efficiently.</li> </ul>		
1	(e)	(i)	Responses may include: <ul style="list-style-type: none"> <li>liaise between project manager and project team members</li> <li>support the project manager</li> <li>co-ordinate own team</li> <li>motivate own team</li> <li>sets example to own team</li> <li>report to project manager</li> <li>ensure issue logs are completed</li> <li>escalate problems to project manager.</li> </ul>	1	For one mark.
1	(e)	(ii)	Responses may include: <ul style="list-style-type: none"> <li>specialist knowledge</li> <li>independent viewpoint</li> <li>broader perspective</li> <li>objectivity</li> <li>avoidance of corporate politics</li> <li>possible knowledge of other industrial sectors.</li> </ul>	1	For one mark.
1	(e)	(iii)	Responses may include: <ul style="list-style-type: none"> <li>find common ground</li> <li>show a personal interest in team members</li> <li>validate others</li> <li>match and mirror behaviour</li> <li>use emotional intelligence</li> <li>be supportive</li> <li>connect to the same goals</li> <li>encourage face to face communication</li> <li>spend time getting to know team members.</li> </ul>	2	Up to two marks for description.

Question			Answer	Marks	Guidance
			<p>Exemplar response: e.g. Ashley could spend time getting to know his team (1) and show a genuine interest in the welfare of team members (1).</p>		
1	(e)	(iv)	<p>Use level of response criteria.</p> <p>Responses may include:</p> <ul style="list-style-type: none"> <li>• requirement to report to project board/sponsor</li> <li>• communication with stakeholders may affect the outcome</li> <li>• need to encourage project team members to work as one</li> <li>• good people management requires good communication</li> <li>• needs to liaise with resource holders.</li> </ul> <p>Exemplar responses:</p> <p>e.g. Ashley's team comprises employees he has never worked with before and two external consultants (CONT). In general, managing people you have never met is more difficult than managing people you know. Ashley needs to use excellent communication skills to ensure that everyone knows what they have to do and why they need to do it. Ashley needs to ensure that he communicates to the team that he is working with them and not against them. (L2)</p> <p>e.g. A project manager needs good communication skills because part of their job involves regular reporting to the project sponsor outlining the progress of the project. This communication must be timely and fit for purpose. (L1)</p>	4	<p>Level of response:</p> <p>Level 2: 3-4 marks Candidate explains why Ashley needs good communication skills to manage the project with use of context.</p> <p>Level 1: 1-2 marks Candidate explains why a project manager needs good communication skills with no use of context.</p>

Question			Answer	Marks	Guidance
2	(a)		<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• Advantages: pay in instalments, low interest rate (3%), can choose repayment term, does not impact on corporate control.</li> <li>• Disadvantages: debt finance, interest charged, collateral required, may lose assets if not repaid, negative impact on gearing, interest rates may rise.</li> </ul> <p>Exemplar responses:</p> <p>e.g. One advantage of using a bank loan to fund the cost of the CNC machines is that the money can be paid back in instalments (1), improving cash flow in the short term (1).</p> <p>e.g. One disadvantage of using a bank loan is that interest is charged (1), this increases the amount of money Collins Machined Components Ltd will have to pay back in the long term (1).</p>	2 x 2	<p>One mark for a correct identification of an advantage, plus one mark for explanation.</p> <p>One mark for a correct identification of disadvantage, plus one mark for explanation.</p>
2	(b)	(i)	<p>Indicative content:</p> <p>Activity H: Off-site training.</p>	1	For one mark.
2	(b)	(ii)	<p>Indicative content:</p> <p>2 weeks.</p>	1	<p>For one mark.</p> <p>Award equivalents.</p> <p>Units required.</p>
2	(b)	(iii)	<p>Indicative content:</p> <p>Activity J: Testing and Activity K: On-site training.</p>	1	<p>For one mark.</p> <p>Both required for one mark.</p>

Question			Answer	Marks	Guidance
					Do not award answers which give additional activities e.g. do not award 'Activities J, K and L'.
2	(b)	(iv)	Indicative content:  2 weeks.	1	For one mark.  Award equivalents.  Units required.
2	(b)	(v)	Indicative content:  Activity J: Testing.	1	For one mark.
2	(b)	(vi)	Indicative content:  15 weeks.	1	For one mark.  Award equivalents.  Units required.
2	(b)	(vii)	Indicative content:  $15 + (3 - 1) = 15 + 2 = 17$ weeks.  Exemplar responses:  e.g. 17 weeks (2)  e.g. 17 (1)  e.g. 15 +2 (1)  e.g. 18 (1)	2	Up to two marks.  Award full marks (two) for the correct answer '17 weeks'.  Else award max one mark for '+2' or '+3' or '18' weeks, if seen.  Accept equivalents.  Units required for full marks. Award max one mark for '17'.
2	(b)	(viii)	Indicative content:	1	For one mark.

Question		Answer	Marks	Guidance
		Activities: A, B, C, E, I, L. or Market analysis, Negotiation with suppliers, Chosen supplier instructed, Off-site manufacture, CNC installation, Commission and handover.		
2	(c)	<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• recruitment gaps</li> <li>• skills gaps</li> <li>• ill health</li> <li>• absenteeism</li> <li>• team member holidays</li> <li>• supplier non-availability</li> <li>• injury.</li> </ul> <p>Exemplar response:</p> <p>e.g. Ashley needs to prepare for the possibility of team members being off sick (1) as this would slow down the progress of the project if alternative staff were not available (1).</p>	4	<p>One mark for each correct identification to a maximum of two identifications, plus one mark for each of two developments.</p> <p>Contingencies must relate to human resources.</p>
2	(d)	<p>Indicative content:</p> $E = \frac{O + 4M + P}{6}$ $E = \frac{15 + 72 + 27}{6} \text{ weeks}$ $E = \frac{114}{6} = 19 \text{ weeks}$ <p>Exemplar responses:</p>	3	<p>Up to three marks.</p> <p>Award full marks (three) for the correct answer '19 weeks'.</p> <p>Else: Award two marks for '114' if seen. or Award one mark for '72' if seen.</p> <p>Units required for full marks. Award max two marks for '19'</p>

Question			Answer	Marks	Guidance
			<p>e.g. 19 weeks (3)</p> <p>e.g. 19 (2)</p> <p>e.g. 114 (2)</p> <p>e.g. 72 (1)</p>		
3	(a)	(i)	<p>Use level of response criteria.</p> <p>Responses may include:</p> <ul style="list-style-type: none"> <li>• did not realise the importance of</li> <li>• has not intervened early enough</li> <li>• has shied away from the issue</li> <li>• leadership/direction unclear</li> <li>• leadership lacks power/control</li> <li>• leadership undermined</li> <li>• failed to set ground rules</li> <li>• too passive</li> <li>• not assertive enough</li> <li>• not proactive enough</li> <li>• hoped the problem would go away</li> <li>• delegated too much responsibility to project team leaders.</li> </ul> <p>Exemplar responses:</p> <p>e.g. Ashley may have been unaware of how important it is to deal with areas of conflict because this is the first project he has managed (CONT). Therefore, instead of laying down strict ground rules for the way team members (including consultants) behave he allowed the problem to get worse due to lack of direction. (L2)</p>	4	<p>Level of response:</p> <p>Level 2: 3-4 marks Candidate explains how Ashley's poor leadership skills could have contributed to Problem One with use of context.</p> <p>Level 1: 1-2 marks Candidate explains how a project manager's poor leadership can lead to unmanaged conflict with no use of context.</p>

Question			Answer	Marks	Guidance
			e.g. Poor leadership skills can lead to a manager being too passive. This can lead to consultants ignoring his direction and behaving how they wish. (L1).		
3	(a)	(ii)	<p>Use level of response criteria.</p> <p>Possible responses include:</p> <ul style="list-style-type: none"> <li>• avoid conflict</li> <li>• conflict mitigation</li> <li>• manage tension</li> <li>• management style</li> <li>• team building</li> <li>• negotiation</li> <li>• timely intervention</li> <li>• use team leaders.</li> </ul> <p>Exemplar response:</p> <p>e.g. One way Ashley could have managed the conflict in Problem One is by intervening as soon as the first entries in the issue log indicated that there was a problem (L1). Ashley could have spoken to each of the consultants individually and established ground rules for the way they were to behave (L2). This method would allow Ashley to control the situation directly and ensure that the consultants understood the importance of the project meeting its objectives and completing to deadline (L3). Alternatively, Ashley could have given some ad hoc training to his two team leaders on how to minimise the conflict (L2). This would delegate the responsibility to the two team leaders, freeing up Ashley's time to deal with issues that only the project manager can handle (L3).</p>	6	<p>Level of response:</p> <p>Level 3: 5-6 marks Candidate analyses how Ashley could have managed the conflict in Problem One.</p> <p>Level 2: 3-4 marks Candidate explains how Ashley could have managed the conflict in Problem One.</p> <p>Level 1: 1-2 marks Candidate identifies how Ashley could have managed the conflict in Problem One.</p>

Question			Answer	Marks	Guidance
3	(b)	(i)	Indicative content: <ul style="list-style-type: none"> <li>length of bolts</li> <li>quantity of bolts.</li> </ul>	1	One mark for a correct identification.
3	(b)	(ii)	Responses may include: <ul style="list-style-type: none"> <li>specific</li> <li>relevant</li> </ul>	1	One mark for a correct identification.
3	(b)	(iii)	Indicative content: <p>Machine 1: 900 bolts with length 15.06 cm  Machine 2: 800 bolts with length 15.92 cm  Machine 4: 500 bolts with length 14.93cm  Machine 4: <u>500</u> bolts with length 15.41 cm  2700 bolts outside of control limits.</p> <p>Exemplar responses:</p> <p>e.g. 2700 (2)</p> <p>e.g. 900 + 800 + 1000 (1)</p> <p>e.g. Bolts with lengths 15.06 cm, 15.92 cm, 14.93 cm and 15.41 cm (1)</p>	2	Up to two marks.  Award full marks (two) for the correct answer '2700'.  Else: Award max one mark if the correct four batches of bolts are identified.  No units required.
3	(b)	(iv)	Responses may include: <ul style="list-style-type: none"> <li>investigate the cause (compare with machine 3)</li> <li>switch programmers/operators of machine 3 and another machine</li> <li>adjust the machines (1, 2 and 4)</li> <li>recalibrate the machines (1, 2 and 4)</li> <li>reprogram the machines (1, 2 and 4)</li> <li>request replacement/repair of machines (1, 2 and 4)</li> <li>train/retrain employees.</li> </ul>	6	One mark for each correct identification to a maximum of two identifications, plus up to two further marks for each of two explanations.  In addition to the identification mark: Award two marks for a contextual explanation. Award one mark for a non-contextual explanation.  Do not award 'adjust the control limits'.

Question		Answer	Marks	Guidance
		<p>Exemplar responses:</p> <p>e.g. Ashley should identify the cause of the problem (1) by switching the operator of machine 3 (CONT) to one of the errant machines to see if the problem lies with the machine or the operator (2).</p> <p>e.g. Ashley should request that the employees be given further training (1) in order to improve their programming skills (1).</p>		
4	(a)	<p>Use level of response criteria.</p> <p>Responses may include:</p> <ul style="list-style-type: none"> <li>• interest rates have increased by 2% (accept bank loan increased from 3% to 5%)</li> <li>• fall in the exchange rate (Sterling weakened against the Australian Dollar from 1.75 to 1.55)</li> <li>• the rate of inflation has doubled</li> <li>• other economic factors e.g. disposable income, unemployment rate</li> <li>• market conditions</li> <li>• competition</li> <li>• political factors</li> <li>• social factors</li> <li>• technological factors</li> <li>• legal factors</li> <li>• environmental factors.</li> </ul> <p>Exemplar response:</p> <p>e.g. An increase in interest rates would lead to an increase in the cost of borrowing (L1). This would mean that Collins Machined Components Ltd monthly repayments on its bank</p>	12	<p>Level of response:</p> <p>Level 4: 10-12 marks Candidate evaluates external factors which may have negatively affected the outcome of Ashley's project.</p> <p>Level 3: 7-9 marks Candidate analyses external factors which may have negatively affected the outcome of Ashley's project.</p> <p>Level 2: 4-6 marks Candidate explains external factors which may have negatively affected the outcome of Ashley's project.</p> <p>Level 1: 1-3 marks Candidate identifies external factors which may negatively affect a project.</p> <p>Do not award internal factors.</p>

Question		Answer	Marks	Guidance
		<p>loan will be higher than expected (L2). This will increase the cost of the project and may well have led to a budget overspend (L3), however it is unlikely to have had caused any time creep (L4).</p> <p>Another external factor which could have affected the outcome of Ashley's project is market conditions (L1). If the market for CNC machines was particularly buoyant then the Australian supplier may have been experiencing high demand (L2). This might have led the supplier to increase the price it charges for its CNC machines, thus leading to increased costs for the project and a budget overspend (L3). In addition, if the supplier was particularly busy the on-site survey may have been delayed and likewise the production, installation and commissioning of the CNC machines. This factor, therefore, could not only lead to a budget overspend but also to time creep resulting in the project missing its agreed deadline (L4).</p>		
4	(b)	<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• confirmation of project completion</li> <li>• completion figures</li> <li>• complaints analysis</li> <li>• informal chat e.g. business breakfast with Chamber of Commerce representative</li> <li>• formal meeting</li> <li>• questionnaire.</li> </ul>	2	<p>One mark for each correct identification, to a maximum of two identifications.</p> <p>Methods required, do not award 'objective' or 'subjective'.</p>
4	(c)	<p>Responses may include:</p> <ul style="list-style-type: none"> <li>• to receive an external viewpoint on own performance</li> <li>• to identify his strengths</li> <li>• to identify his weaknesses</li> <li>• to highlight areas for improvement</li> <li>• to build his confidence</li> </ul>	6	<p>One mark for each correct identification to a maximum of two identifications, plus up to two further marks for each of two explanations.</p> <p>In addition to the identification mark: Award two marks for a contextual explanation. Award one mark for a non-contextual explanation.</p>

Question	Answer	Marks	Guidance
	<ul style="list-style-type: none"> <li>• to recognise project successes and failures</li> <li>• to identify lessons learned</li> <li>• to find out if his leadership skills have improved</li> <li>• to find out if his management of conflict has improved</li> <li>• to improve future performance.</li> </ul> <p>Exemplar responses:</p> <p>e.g. Obtaining feedback on his performance will help Ashley identify weaknesses in his personal performance (1). This will be especially important to Ashley because it is the first project he has managed since completing his diploma (CONT). He can use the information to improve the way he manages his second project (2).</p> <p>e.g. Ashley can compare the feedback he receives with his own personal opinion on his performance (1). The feedback may identify areas for improvement which Ashley had not thought of himself (1).</p>		