Mark Scheme
Summer 2009

Engineering

Level 3

EG301/01 EG308/01

A PEARSON COMPANY

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

http://www.edexcel.com/Aboutus/contact-us/

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.

- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.

- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.

- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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SECTION A

Question Number	Answer	Mark
1	C	(1)

Question Number	Answer	Mark
2	A	(1)

Question Number	Answer	Mark
3	B	(1)

Question Number	Answer	Mark
4	D	(1)

Question Number	Answer	Mark
5	A	(1)

Question Number	Answer	Mark
6	B	(1)

Question Number	Answer	Mark
7	D	(1)

Question Number	Answer	Mark
8	A	(1)

Question Number	Answer	Mark
9	D	(1)

Question Number	Answer	Mark
10	B	(1)

Question Number	Answer	Mark
11	A	(1)

Question Number	Answer	Mark
12	B	(1)

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13	D	(1)

Question Number	Answer	Mark
14	D	(1)

Question Number	Answer	Mark
15	A	(1)

Question Number	Answer	Mark
16	B	(1)

Question Number	Answer	Mark
17	B	(1)

Question Number	Answer	Mark
18	B	(1)

Question Number	Answer	Mark
19	D	(1)

Question Number	Answer	Mark
20	B	(1)

SECTION B

Question Number	Answer	Mark
21	Any two of the following: • The absence / reduction of risk in the handling / storage / transport of articles / substances / provide PPE / reduce the number of accidents (1) • Instruction / training / supervision to ensure health and safety at work (1) • The maintenance of the workplace / environment to be safe / without risk (1) • To provide a health and safety policy statement (1) • To ensure that the public / visitors are not exposed to risk (1)	**(2)**

Question Number	Answer	Mark
22	Any four of the following: • Available resources (including time) (1) • The materials / components/ parts needed (1) • The processes which are to be used (1) • The available equipment/tools/machinery (1) • The order of production operations (1) • How quality will be checked / controlled (1) • Issues relating to Health and Safety / Risk Assessments (1) • Critical control points (1) • Production / operational schedule (1) • Product specification (1) Or any other reasonable answer	**(4)**

Question Number	Answer	Mark
23 (a)	Any two from the following: • Anything of value which is received by the company (1) • Monies coming into the business (1) • Personal earnings of an employee (1) • Cash / credit received from the sale of goods / services (1) • Services/goods/property received in exchange for products (1) • Interest earned on lettings / savings (1)	(2)

Question Number	Answer	Mark
23 (b)	Any two from the following: • Monies paid out by a business (1) including those for materials / components (1) • Expenses such as salaries / light & heat / premises (1) • Cost of hire / lease / purchase of equipment/ tooling (1)	(2)

Question Number	Answer	Mark
24 (a)	A sketched chart is acceptable 1 mark for each of the following: • Number sold axis correctly labelled (1) • Cost axis correctly labelled (1) If values only shown award 1 mark 	(2)

Question Number	Answer	Mark
24 (b)	1 mark for each of the following correctly labelled • Total Costs (1) • Fixed Costs (1) • Break Even Point (1)	(3)

Question Number	Answer	Mark
24 (c)	£1000 if solution comes from graph reading, allow variation due to accuracy	(1)

Question Number	Answer	Mark
25	Any **four** valid points from the following are acceptable for 1 mark each • To promote economic development / regeneration (1) • To promote employment (1) • To contribute to sustainable development (1) • To promote investment / efficiency / competitiveness in business (1) • To increase and develop skills related to employment (1) • To advise on grants available for employers setting up in the region (1) • Regional plans (1) • To help develop strategic plans (1)	(4)

SECTION C

Question Number	Answer	Mark
26 (a)	Any two valid points with justification for 2 marks each. Examples could include: • The structure is more flexible (1) and is able to respond to the changes in the local market (1) • Each division is self contained (1) and is therefore more responsible for its own performance (1) • The market for the products in each division is different (1) therefore allowing vehicles to be made which are suited to local needs (1) • Production can be increased or decreased (1) in response to local market conditions (1) • Manufacturing costs are shared / reduced (1) as wages are paid to local workforce at the local rate (1) • Labour costs can be reduced by doing most of the manufacture in areas with lower pay rates (1) • Transportation costs are reduced (1) since vehicles are manufactured closer to the final market (1) • Different cultures in the world (1) would prefer to have different designs (1) • Increased customer base (1) could lead to greater profits (1)	(4)

Question Number	Answer	Mark
26 (b)	For 2 marks a reason must be given with a justification • Removes duplication of research (1) thereby saving time and money (1) • Innovation and technical developments can be shared (1) allowing for more advanced products to be developed (1) • All products within the companies range benefit from new technology (1) giving the company a competitive edge (1) • R&D ongoing (1) and not susceptible to changes in market conditions (1)	(2)

Question Number	Answer	Mark
26 (c)	For full marks both local and global issues must be addressed • The local economy benefits with more employment (1) therefore raising the standard of living (1) • Local people are able to gain employment (1) • Large available workforce (1) • Local people become more wealthy (1) which allows economic growth in the area / region (1) • Enables transfer of knowledge/technology (1) which increases the skills of workers (1) • The company benefits from lower salaries being paid (1) which allows them to sell products at a lower price (1) • Wealth is shared amongst nations (1) • Higher profits can be made (1) which could be re-invested into expanding markets (1) • Lower manufacturing costs (1) • Workers gain transferable skills (1)	(4)

Question Number	Answer	Mark
27 (a)	 • Correctly labelled activities (1) • Label the dummy activity (1) • 24 days (1)	(3)

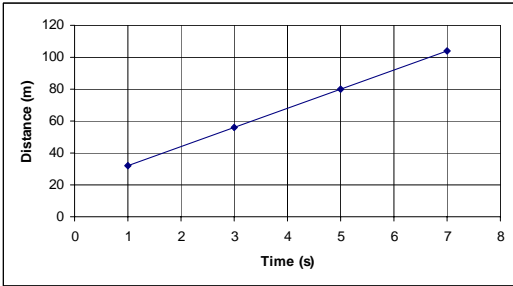| Question Number	Answer	Mark
27 (b)	Any 2 valid points acceptable • Identify the hazards (1) • Decide who may be harmed (1) • Evaluate risks and decide upon precautions (1) • Record findings and follow them (1) • Note required precautions (1) • Identify necessary PPE (1)	(2)

Question Number	Answer	Mark
28	- Use recycled / recyclable / reclaimed materials (1) to reduce the impact of extraction of materials (1) - Use more energy efficient production methods (1) to reduce emissions (1) - Use alternative energy sources (1) to reduce dependence on finite resources (1) - Locate manufacturing plants near to markets or sources of materials (1) to reduce transportation - Reduce the amount of materials required in products (1) - Design for easy maintenance (1) rather than replacing products (1) - Design products which are easy to reuse or recycle (1) - Manufacture using lean principles (1) - Reduce the amount of energy used (1) - Reduce the carbon footprint of the business / processes (1) - Reduce waste (1) by recycling (1) - Reduce noise pollution (1) - Use / build more energy efficient manufacturing plants / factories (1) - Use waste / excess heat from manufacture (1) to heat the workplace (1) - Filter emissions from manufacture to remove pollutants (1)	(5)

Question Number	Answer	Mark	Coverage
1 (a)	$v^2 = u^2 + 2as$		
	$v^2 - 2as = u^2$		B1
	$u = \sqrt{v^2 - 2as}$		B1
	$u = \sqrt{10^2 - 2 \times 9.81 \times 3}$		M1
	$u = 6.41$ (accept 2 decimal places)	(4)	A1

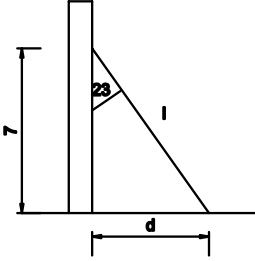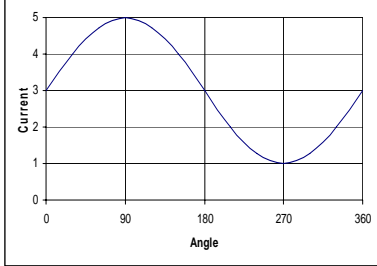| Question Number	Answer	Mark	Coverage
1 (b)	$2\log 3 + \log x = \log 36$ $\log x = \log 36 - 2\log 3$ $\log x = \log 36 - \log 3^2$ $\log x = \log 36 - \log 9$ $\log x = \log \dfrac{36}{9}$ $\log x = \log 4$ $x = 4$ Alternative solution $2\log 3 + \log x = \log 36$ $\log 9 + \log x = \log 36$ $\log 9x = \log 36$ $x = 4$ Alternative Solution $2\log 3 + \log x = \log 36$ $0.954 + \log x = 1.536$ $\log x = 1.536 - 0.954$ $\log x - 0.682$ $x = 4$	B1 M1 A1 B1 M1 A1 B1 M1 A1 (3)	

Question Number	Answer	Mark	Coverage
1 (c)	$i = 10e^{-\frac{t}{\tau}}$ $-\tau \ln\left(\dfrac{i}{10}\right) = t$		M1
	$-12 \ln\left(\dfrac{5}{10}\right) = t$ $-12 \times -0.693 = t$		M1
	$t = 8.32 \text{ s}$	(3)	A1

Question Number	Answer	Mark	Coverage
2 (a)	 Graph plotted Velocity calculated from: $v = \dfrac{\Delta d}{\Delta t} = \dfrac{72}{6} = 12$ ms^{-1} or equivalent points from the graph (one mark for gradient, one mark for calculated value) At $t = 0$, $d = 32 - 12 = 20$ m At $t = 10$, $d = 20 + 10 \times 12 = 140$ m	 B1 M1 A1 B1 (5) B1	

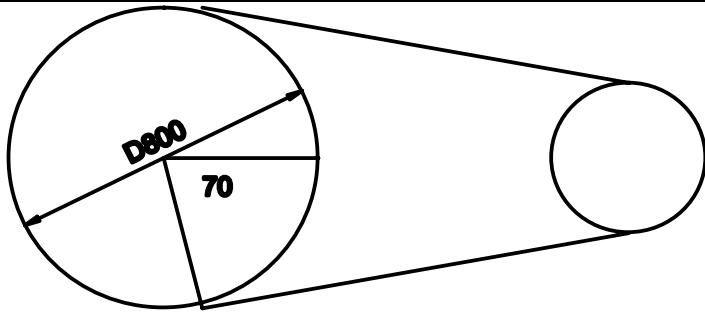| Question Number	Answer	Mark	Coverage
2 (b)	$\dfrac{a}{a^2 - b^2} - \dfrac{b}{a^2 - b^2}$ $= \dfrac{a - b}{a^2 - b^2}$ $= \dfrac{a - b}{(a + b)(a - b)}$ $= \dfrac{1}{a + b}$	 M1 M1 A1 (3)	

Question Number	Answer	Mark	Coverage
2 (c)	$h = x^2 + 3x - 10$ produces: $0 = (x + 5)(x - 2)$ $x = -5 \ or \ x = 2$ SC: one mark for x = 5 and x = -2 one mark for X = 1 or X = -5	 M1 A1 (2)	

Question Number	Answer	Mark	Coverage
3 (a)			
	Correctly identify $\tan\theta = \dfrac{opp}{adj}$	M1	
	Insert correct values and calculate $\tan 23^{0} = \dfrac{d}{7}$	M1	
		A1	
	$d = 7 \times 0.424 = 2.97\,\text{m}$		
	Calculate stay length from $\sqrt{7^2 + 2.97^2} = 7.6\,\text{m}$	M1	
		(4)	
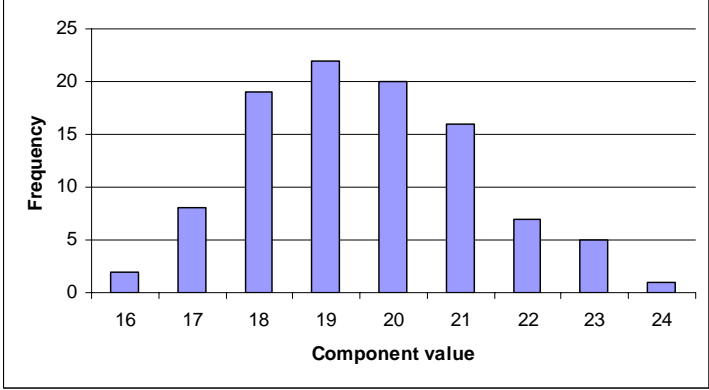
Question Number	Answer	Mark	Coverage
3 (b)			B1 shape
			B1 all points
	Graph correctly sketched (one mark for amplitude and one mark for offset)		
	Reading from graph at $\theta = 90^{0}$, $i = 5$	(3)	B1

Question Number	Answer	Mark	Coverage
3 (c)	Side C determined from:		
	$c^2 = a^2 + b^2 - 2ab\cos A$	M1	
	$c^2 = 110^2 + 92.2^2 - 2 \times 110 \times 92.2 \times \cos 50^{0}$	M1	
	$c = 87.0\,\text{mm}$	(3)	A1

Question Number	Answer	Mark	Coverage
4 (a)	Volume of cuboid $= 75 \times 75 \times 12 = 67500 \, \text{mm}^3$		B1
	Volume of hole $= \dfrac{\pi d^2}{4} \times 12 = \dfrac{\pi 1600}{4} \times 12 = 15080$ mm^3		B1
	Remaining volume $= 67500 - 15080 = 52420$ mm^3	(3)	B1

Question Number	Answer	Mark	Coverage
4 (b)			
	Angle of the drive-wheel connected to the pulley:		
	$A = 360 - (2 \times 70) = 220^0$	B1	
	Circumference $= 800 \times \pi$	M1	
	Length $l = 2513 \times \dfrac{220}{360} = 1536$ mm	A1 A1	
	One mark for calculation, One mark for correct answer Follow through allowed	(4)	

Question Number	Answer	Mark	Coverage
4 (c)	1 radian per second $= \dfrac{1}{2\pi}$ revolutions per second		M1
	500 radians per second $= \dfrac{500}{2\pi} = 79.6$ revolutions per second		B1
	$= 79.6 \times 60 = 4776$ rpm	(3)	A1

Question Number	Answer	Mark	Coverage
5 (a)	 one mark for histogram one mark for any six correct two marks for all nine correct	(3)	B3

Question Number	Answer	Mark	Coverage
5 (b)	Median = 19		M1 B1
	Mode = 19		B1
	Mean = $\dfrac{\Sigma fx}{\Sigma f} = \dfrac{1957}{100} = 19.57$	(5)	M1 A1

Question Number	Answer	Mark	Coverage
5 (c)	Mean, mode and median all less than nominal diameter/size	(1)	B1

Question Number	Answer	Mark	Coverage
6 (a)	Tangent drawn at $t = 2$ Change in velocity identified as 27 -87 = -60 Change in time identified as 5 – 0 = 5 Acceleration calculated as $\dfrac{-60}{5} = -12$ ms^{-2} Or any suitable combinations of values Accept a range -10 to -15ms^{-2}	M1 B1 B1 A1 (4)	

Question Number	Answer	Mark	Coverage
6 (b)	$v = 75 - 3t^2$ $a = \dfrac{dv}{dt}$ $a = -6t$ At $t = 2$: $\quad a = -6 \times 2 = -12\,\text{ms}^{-2}$ One mark for acceptable answer from (a) copied to (b) with no working	M1 A1 A1 (3)	

Question Number	Answer	Mark	Coverage
6 (c)	$s = \int_0^5 (75 - 3t^2)\,dt$ $s = \left[75t - t^3 (+c)\right]_0^5$ $s = (75 \times 5) - 5^3 (+0)$ $s = 250\,\text{m}$ (+c) and (+0) are optional	M1 A1 M1 A1 (4)	