Please revise the following text to suit your requirements.

This sample scheme of work covers both classroom and workshop based learning for Unit 308. It is based on 90 hours across 15 sessions plus additional hours for independent learning.

This is only an example of a possible scheme of work. You can use it as it is, adjust it or extract content to suit your delivery needs, or the needs of individual learners.

The schemes of learning are intended to be learner-focused, and embrace current pedagogical methodology such as flipped and blended learning.

A version of this scheme of learning with **full supporting materials** is also available to purchase on **SmartScreen.co.uk**.

Where possible we have included blended learning activities that make good use of technology so as to help centres fulfil the minimum amount of digital teaching recommended by government.

Centres should also provide opportunities within the unit content to introduce the following wider skills and government initiatives:

- English, mathematics and ICT
- employability skills and behaviours
- British values (including the Prevent strategy).

Centres should also incorporate the following themes, where appropriate. Although they are not specifically referred to in the scheme of learning, City & Guilds regards these as essential in the teaching of the qualification:

- spiritual, moral, social and cultural issues
- health and safety considerations, in particular the need to impress upon learners the fact that they must preserve the health and safety of others as well as themselves
- environmental education and related European issues.

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Lesson 1: Steering system diagnosis **Suggested teaching time:** 6 hours

Learning outcome: Test vehicle components.

Topic	Suggested teaching	Suggested resources
Topic 1.1 Chassis components.	Introduce the topic of testing chassis components and diagnosing faults. Begin by explaining to the group the initial concepts and rational of fault diagnosis. Discuss steering system (manual, hydraulic and electrical) testing with the learners. Explain the expected faults, including excessive wear and adjustments. **Opportunity for applied learning** • Learners to research the diagnostic methods and equipment that would be used to test the steering system. (Visual, audible, multi-meter four wheel alignment equipment etc.) • Conduct a practical workshop session giving the learners the opportunity to diagnose predetermined faults using prescribed methods. • Learners to strip steering sub-assemblies so an examination can take place to the serviceability of the unit.	Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917 Bosch Automotive Handbook – R Bosch Gmbh, 9th edition, 9th edition ISBN-13: 978-1119032946 http://cdn.intechopen.com/pdfs-wm/10360.pdf http://autotechl.com/MATChapters/MATChapter_70SteeringSysDiagRepair.pdf www.carbibles.com/steering_bible.html

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Lesson 2: Suspension system diagnosis **Suggested teaching time:** 6 hours

Learning outcome: Test vehicle components.

Topic	Suggested teaching	Suggested resources
Topic 1.1 Chassis components.	Recap on previous lesson about diagnosing steering faults. Discuss with the learners the expected faults that occur suspension systems (conventional, air, and electrical/electronic control), including leaks and damaged components. **Opportunity for applied learning** • Learners to research the diagnostic methods and equipment that would be used in testing suspension systems (visual, audible, multi-meter four wheel alignment equipment etc.) • Conduct a practical workshop session giving the learners the opportunity to diagnose predetermined faults using prescribed methods. • Learners to strip suspension sub-assemblies so an examination can take place to the serviceability of the unit.	http://autotechl.com/MATChapters/MATChapter_68SuspDiagRepair.pdf www.carbibles.com/suspension_bible.html Video links: YouTube Mercedes-Benz active body control – fully active suspension technology: www.youtube.com/watch?v=Df2mM5jP1W0 Monroe CCES (continuous control electronic suspension): www.youtube.com/watch?v=zkado-fNddo

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Lesson 3: Braking system diagnosis

Suggested teaching time: 6 hours

Learning outcome: Test vehicle components

Topic	Suggested teaching	Suggested resources
Topic 1.1 Chassis components.	Recap previous lesson on diagnosing suspension faults. Discuss with the learners the expected faults that occur in braking systems (hydraulic, air, electronic control systems and testing), including judder, grab, and brake fade. **Opportunity for applied learning** • Learners to research the diagnostic methods and equipment that would be used in testing braking systems (visual, audible, multi-meter four wheel alignment equipment etc.) • Conduct a practical workshop session giving the learners the opportunity to diagnose predetermined faults using prescribed methods. • Learners to strip braking sub-assemblies so an examination can take place to the serviceability of the components.	www.howacarworks.com/basics/how-the-braking-system-works Video links: YouTube Electronic brake-force distribution (EBD): www.youtube.com/watch?v=PTPavSBS_OE Race friction dyno testing by Raybestos brakes: www.youtube.com/watch?v=3izCsazV0rk How to diagnose a brake problem: www.youtube.com/watch?v=V_wk44U44HI

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Lesson 4: Petrol fuel management system diagnosis

Suggested teaching time: 6 hours

Learning outcome: Test vehicle components.

Topic	Suggested teaching	Suggested resources
Topic 1.2 Engine components.	Introduce the topic on testing engine management petrol systems and diagnosing faults. Discuss with the learners the expected faults that occur in engine management petrol systems (indirect, direct, and electronic control), including misfire, loss of power and non-start. **Opportunity for applied learning** • Learners to research the diagnostic methods and equipment that would be used in testing engine management petrol systems. • Conduct a practical workshop session giving the learners the opportunity to diagnose predetermined faults using prescribed methods. • Learners to strip petrol fuel injection sub-assemblies so an examination can take place to the serviceability of the components.	www.s262612653.websitehome.co.uk/ems/ Video links: YouTube How to diagnose an engine misfire − fuel, fire or compression: www.youtube.com/watch?v=fWlAVrCPnfE How to test and replace an engine coolant temperature sensor: www.youtube.com/watch?v=bPAIFL8VH9w Camshaft position sensor testing: www.youtube.com/watch?v=itMXO56z1tw

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Lesson 5: Diesel fuel management system diagnosis

Suggested teaching time: 6 hours

Learning outcome: Test vehicle components.

Topic	Suggested teaching	Suggested resources
Topic 1.2 Engine components.	Recap previous lesson on petrol fuel injection systems. Discuss with the learners the expected faults that occur in diesel fuel injection systems (indirect, direct, and electronic control), including misfire, loss of power and non-start. **Opportunity for applied learning** • Learners to research the diagnostic methods and equipment that would be used in testing diesel fuel injection systems. • Conduct a practical workshop session giving the learners the opportunity to diagnose predetermined faults using prescribed methods. • Learners to strip diesel fuel injection sub-assemblies so an examination can take place to the serviceability of the components.	Video links: YouTube Diesel common rail injection facts: www.youtube.com/watch?v=7qlVrjxtoY0 How to test common rail diesel injectors: www.youtube.com/watch?v=HwJ_mKuzhxo Common rail diesel low pressure test gauge: www.youtube.com/watch?v=rNCPUAEuX80 Common rail diesel high pressure testing set www.youtube.com/watch?v=fcEJ-E-r38k

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Lesson 6: Emission control system diagnosis

Suggested teaching time: 6 hours

Learning outcome: Test vehicle components.

Topic	Suggested teaching	Suggested resources
Topic 1.2 Engine components.	Recap previous lesson on diesel fuel injection systems. Discuss with the learners the expected faults that occur in the emission control systems (EGR, lambda control, Ad blue), including gas analysis, smoke testing, and live data outputs. Explain the requirement for regulations to govern emission control. Discuss the environmental and health and safety implications of not controlling emissions. **Opportunity for applied learning** • Learners to research the regulations that govern emission control in the UK. Learners should be prepared to discuss their findings with classmates. • Learners to research the diagnostic methods and equipment that would be used in testing emission control systems. • Conduct a practical workshop session giving the learners the opportunity to diagnose predetermined faults using prescribed methods. • Learners to strip emission control system sub-assemblies so an examination can take place to the serviceability of the components.	https://en.wikipedia.org/wiki/European_emission_standards Video links: YouTube EGR valve test: www.youtube.com/watch?v=aWONsOtLzB0 Testing an oxygen/lambda sensor: www.youtube.com/watch?v=AxP54WZKj9k

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Lesson 7: Diagnostic strategies

Suggested teaching time: 5 hours

Learning outcome: Test vehicle components.

Topic	Suggested teaching	Suggested resources
Topic 1.3 Carrying out testing on components.	Introduce the topic on implementing strategies for testing components, reflecting on what was learned within the previous lessons. Discuss and explore with the learners different strategies that provide the best course of action to enable accurate diagnosis and testing of components. To include: • obtaining vehicle specifications including limits, fits, and tolerances (eg pistons/rings, crankshaft) • electrical component function (eg inputs/outputs, voltages, sensors and actuators) • how to evaluate and analyse test results. **Opportunity for applied learning** • Learners to research and produce guidance documentation with the aim of ensuring employees within an automotive business follow best practice when testing components and diagnosing faults. • Learners to analyse and interpret test data, provided by the tutor, to diagnose faults.	Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917

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Lesson 8: Electrical and electronic faults (body and chassis) **Suggested teaching time:** 6 hours

Learning outcome: Carry out electrical and electronic fault diagnosis on vehicle systems.

Topic	Suggested teaching	Suggested resources
Topic 2.1 Diagnosing electrical and electronic faults on chassis and body systems.	Introduce the topic on electrical and electronic fault diagnosis on body and chassis systems. Learners will need to understand the importance of adhering to manufacturer's specifications and time scales when diagnosing chassis and body faults. Learners will also need to: • understand how the various associated vehicle systems interact with each other (including multiplex systems) • understand and interpret vehicle technical data. **Opportunity for applied learning** • Learners to research and produce a document highlighting the procedures used for carrying a diagnostic activity for the body and chassis systems (as highlighted above). • Carry out a practical activity to demonstrate the diagnostic techniques and procedures on the body and chassis systems with regard to multiplexing and how to interpret and evaluate the data.	Advanced Automotive Fault Diagnosis – T Denton Butterworth- Heinemann ISBN-13: 978-0750669917 http://cdn.intechopen.com/pdfs-wm/10360.pdf

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Lesson 9: Electrical and electronic faults (engine management) **Suggested teaching time:** 6 hours

Learning outcome: Carry out electrical and electronic fault diagnosis on vehicle systems.

Topic	Suggested teaching	Suggested resources
Topic 2.2 Diagnosing faults on engine management systems.	Introduce the topic of electrical and electronic fault diagnosis on engine management systems. Learners will need to understand: • the importance of adhering to manufacturer's specifications and timescales when diagnosing engine management system faults. • how the various associated vehicle systems interact with each other (including multiplex systems) • how to interpret vehicle technical data. **Opportunity for applied learning** • Learners to research and produce a document highlighting the procedures used for carrying a diagnostic activity for the engine management systems (as highlighted above). • Carry out a practical activity to demonstrate the diagnostic techniques and procedures on the engine management system, and how to interpret and evaluate the data.	Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917 Bosch Automotive Handbook – R Bosch Gmbh, 9th edition ISBN-13: 978-1119032946 http://cdn.intechopen.com/pdfs-wm/10360.pdf

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Lesson 10: Electrical and electronic diagnostic processes **Suggested teaching time:** 5 hours

Learning outcome: Carry out electrical and electronic fault diagnosis on vehicle systems.

Topic	Suggested teaching	Suggested resources
Topic 2.3 The diagnostic process.	Recap on previous lessons to summarise the strategies and techniques used. Discuss and explain how to follow and carry out the appropriate diagnostic processes in an efficient way. To include: • logical diagnostic sequences • appropriate diagnostic activities (functional/efficiency testing, measurement) • complying with legal and manufacturer's specifications. **Opportunity for applied learning** • Learners to research and document a logical diagnostic sequence for a set of components on a vehicle of their choice. Learners should document reasons for the sequence they have chosen, and be prepared to present to the class.	Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917 Bosch Automotive Handbook – R Bosch Gmbh, 9th edition ISBN-13: 978-1119032946 http://cdn.intechopen.com/pdfs-wm/10360.pdf

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Lesson 11: Electrical and electronic faults (rectifying faults) **Suggested teaching time:** 8 hours

Learning outcome: Carry out electrical and electronic fault diagnosis on vehicle systems.

Topic	Suggested teaching	Suggested resources
Topic 2.4 Using diagnostic equipment to rectify faults.	Recap previous lesson on the diagnostic process. Learner will need to identify and have the skills to use a range of diagnostic equipment required for different vehicle systems including: • fault code reading equipment (OBD/diagnostic socket) • software scanners • oscilloscopes • multi-meters • roller brake testers. **Opportunity for applied learning** • Practical activity to introduce learners to available diagnostic equipment (from the list above) to diagnose vehicle system faults associated with the chassis and body, engine management, and electrical/electronic systems. • Learners to work in groups using appropriate diagnostic equipment to gather live data, compare with manufacturer's data, and interpret results to diagnose faults correctly.	Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917 Bosch Automotive Handbook – R Bosch Gmbh, 9th edition ISBN-13: 978-1119032946 Video links: YouTube OBD2 fault code diagnostic scanner/readers: www.youtube.com/watch?v=GvUu99oZteI Picoscope basics: www.youtube.com/watch?v=81AGbZcgCZs

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Lesson 12: Introduction to wave forms

Suggested teaching time: 5 hours

Learning outcome: Analyse wave forms

Topic	Suggested teaching	Suggested resources
Topic 3.1 Wave forms in vehicle systems.	Introduce the topic relating to the different wave forms used in vehicle systems. Discuss with learners: • the types of wave forms • how they are formed • how they can be used make an accurate diagnosis of system faults. To include: • analogue, sinusoidal wave • digital, hall effect, duty cycle • multiplex systems • binary code. **Opportunity for applied learning** • Learners to identify the expected waveform patterns for a variety of chassis, engine management and electrical/ electronic systems (sensor and actuator input and output signals).	Advanced Automotive Fault Diagnosis – T Denton Butterworth- Heinemann ISBN-13: 978-0750669917 Bosch Automotive Handbook – R Bosch Gmbh, 9th edition ISBN-13: 978-1119032946 www.picoauto.com/library/automotive-guided-tests/can-l-h

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Lesson 13: Analysing and interpreting wave forms

Suggested teaching time: 6 hours

Learning outcome: Analyse wave forms.

Topic	Suggested teaching	Suggested resources
Topic 3.2 Analysing and interpreting the meaning of wave forms.	Recap from previous lesson. Explain how to analyse the various waveforms produced in vehicle systems, and know how the component or system is being controlled. To include: • voltage over time, peaks and troughs (eg inductive sensor) • inputs and outputs (eg sensor, actuator, potentiometer) • on and off controls (eg digital, hall effect). **Opportunity for applied learning** • Learners to use appropriate diagnostic equipment to measure live data, and analyse against expected output.	Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917 Bosch Automotive Handbook – R Bosch Gmbh, 9th edition ISBN-13: 978-1119032946 www.picoauto.com/library/automotive-guided-tests/can-l-h

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Lesson 14: Back to basics strategies

Suggested teaching time: 5 hours

Learning outcome: Carry out back-to-basics diagnosis.

Topic	Suggested teaching	Suggested resources

Topic 4.1
 	
Diagnosing faults when there is no prescribed process.
	Introduce the topic on diagnosing faults where there is no prescribed process.
	
	Summarise with the learners what has been learned so far about diagnostic processes within different vehicle systems.
	
	Discuss with learners how they should devise, analyse and implement strategies that provide the best course of action to enable accurate diagnosis and repair of faults when the application of a known or manufacturer diagnostic procedure has failed to reveal the source and cause of identified problems. This might include:
	• interpreting data (eg paper/electronic, wiring diagrams/technical manuals)
	• understanding the operation of vehicle components and sub-assemblies including:
	  ○ chassis systems – antilock braking systems (ABS)
	  ○ engines – ignition
	  ○ electrical starting and charging systems
	• visual and communication skills
	• applying lateral cognitive thinking skills to analyse faults.
	
	Opportunity for applied learning
	• Learners to document a strategy for when there is no prescribed diagnostic procedure available, incorporating all of the above aspects.
		Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917
		
		Bosch Automotive Handbook – R Bosch Gmbh, 9th edition ISBN-13: 978-1119032946

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Lesson 15: Back to basics diagnostic and rectification **Suggested teaching time:** 8 hours

Learning outcome: Carry out back-to-basics diagnosis.

Topic	Suggested teaching	Suggested resources
Topic 4.2 Applying basic fault diagnosis and rectification.	Recap from previous lesson. Learners will need to apply the back-to basics technique when diagnostic equipment fails to identify the cause of the problem by: • using electrical equipment – multi-meter (voltage, resistance and voltage drop), inductive current clamp, power probes • using mechanical equipment – pressure (fuel and lubrication system testing)/vacuum gauges (induction systems). **Opportunity for applied learning** • Learners will need review the strategies created in the previous lesson against the back-to-basics criteria above, and amend accordingly, in preparation for the following practical task. • Learners to carry out various practical activities applying their diagnostic strategies to find set faults incorporated on the various vehicle systems (body, chassis, engine management, electrical and electronic). Learners should use a variation of diagnostic equipment as stated above and be able to analyse the data, to allow for successful rectification.	Advanced Automotive Fault Diagnosis – T Denton Butterworth-Heinemann ISBN-13: 978-0750669917 Bosch Automotive Handbook – R Bosch Gmbh, 9th edition ISBN-13: 978-1119032946

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