



0171-523 MARCH 2018

Level 2 Technical Certificate in Land-Based Engineering

Level 2 Land-Based Engineering – Theory Exam

Friday 16 March 2018
09:30 – 11:30

You should have the following for this examination

- a multiple-choice answer sheet
- a pen with black or blue ink
- a non-programmable calculator

This question paper is the property of the City and Guilds of London Institute and is to be returned after the examination.

Read the following notes before you answer any questions

- You **must** use a pen with black or blue ink to complete **all** parts of the answer sheet.
- Check that you have the correct answer sheet for the examination.
- Check that your name and candidate details are printed correctly at the top of your answer sheet.
- Inform the invigilator if your name or examination details are not correct.
- Each question shows **four** possible answers (lettered 'a', 'b', 'c' and 'd'); only **one** is correct.
- Decide which **one** is correct and mark your answer on the **answer sheet** with your pen.

For example if you decide 'a' is correct, mark your answer like this

101	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Cancel	Cancel	Cancel	Cancel

If you want to change your answer, cancel your first choice by filling in the 'cancel' box below the circle like this

101	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Cancel	Cancel	Cancel	

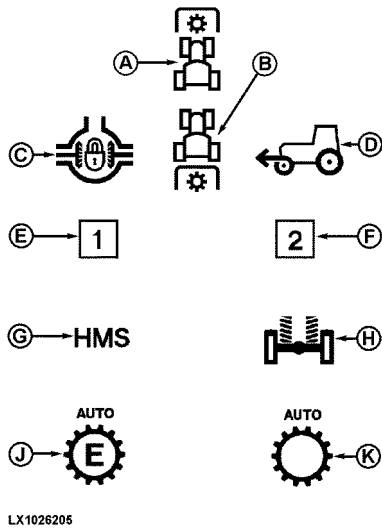
Then mark the answer which you have now decided is correct. For example if you now decide 'c' is correct, mark your answer like this

101	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Cancel	Cancel	Cancel	

Any other marks on the form may invalidate some of your answers.

- Any calculations or rough working can be done on the question paper.
- Attempt all questions. If you find a question difficult, leave it and return to it later.

This paper contains 50 questions. Answer them using the 'boxes' numbered 1 to 50 on the answer sheet.



<http://manuals.deere.com>

Figure 1

- 1 What does warning light C indicate in Figure 1?
 - a The front differential lock is engaged.
 - b The rear PTO is engaged.
 - c The rear differential lock is engaged.
 - d The front PTO is engaged.

- 2 Which one of the following would be classed as the **main** risk when jacking up a vehicle?
 - a Explosion.
 - b Crushing.
 - c Tripping.
 - d Slipping.

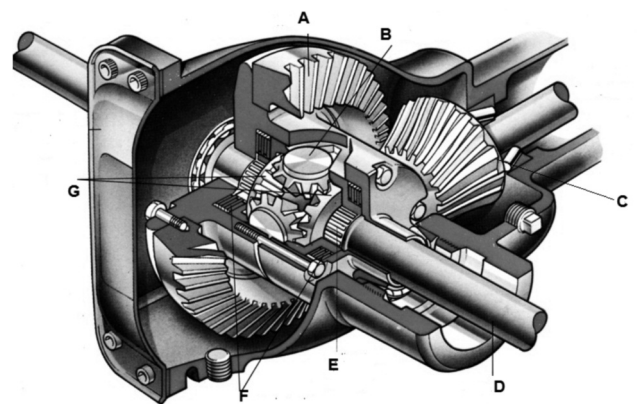
- 3 When carrying out a visual inspection, how is a four wheel drive, land based machine identified?
 - a One live axle and two drive shafts.
 - b Two live axles and two drive shafts.
 - c Two live axles and four drive shafts.
 - d Four live axles and four drive shafts.



<http://www.vronsb.com>

Figure 2

- 4 What type of clutch is shown in Figure 2?
 - a Single plate diaphragm spring clutch.
 - b Multi-plate coil spring clutch.
 - c Single plate coil spring clutch.
 - d Multi-plate diaphragm spring clutch.



www.uniquecarsandparts.com.au

Figure 3

- 5 In Figure 3, gear A has 40 teeth and gear C has 10 teeth. This provides a
 - a 4:1 gear reduction
 - b 4:1 torque reduction
 - c 1:4 gear multiplication
 - d 1:4 torque multiplication.

- 6 Which one of the following tools would be used to check backlash between gears A and C in Figure 3?
 - a Feeler gauges.
 - b Micrometer.
 - c Dial test indicator.
 - d Vernier calliper.

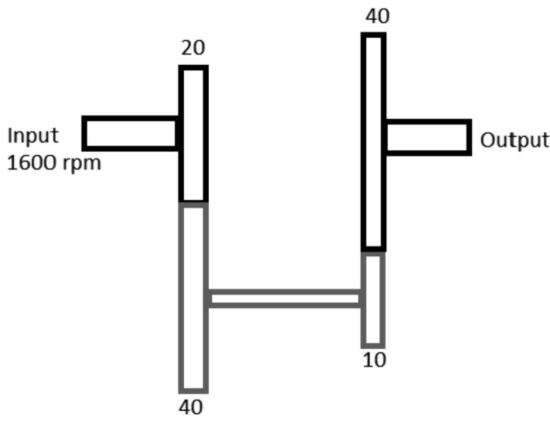
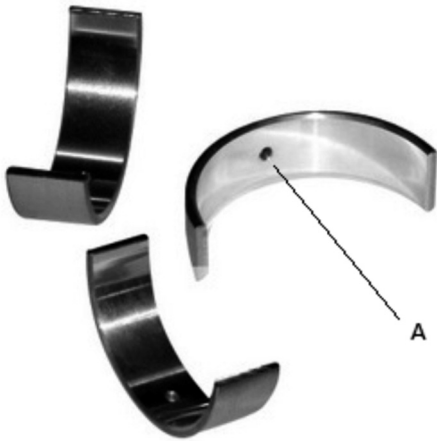


Figure 4

- 7 Which one of the following is the correct speed of the output shaft in Figure 4?
- a 200 rpm.
 - b 400 rpm.
 - c 600 rpm.
 - d 800 rpm.



<https://dir.indiamart.com>

Figure 5

- 8 In Figure 5, the hole labelled A is used to
- a allow excess oil to escape
 - b lubricate the crankshaft
 - c locate the shell bearing
 - d lubricate the camshaft.
- 9 An oil has a SAE rating of 10W30. What does the 'W' stand for?
- a Wetting.
 - b Winter.
 - c Waxing.
 - d Water.

- 10 An octane rating is given to
- a petrol
 - b engine oil
 - c anti-freeze
 - d diesel.
- 11 An EGR valve is fitted between the
- a cylinder head and radiator
 - b inlet manifold and air filter
 - c exhaust and inlet manifolds
 - d turbo charger and air filter.
- 12 A tractor dynamometer connects to the
- a flywheel
 - b rear wheels
 - c power take off
 - d diagnostic socket.
- 13 In a four cylinder, four-stroke diesel engine, how many degrees does the camshaft rotate through to complete the full cycle of operation?
- a 1440°
 - b 1180°
 - c 720°
 - d 360°

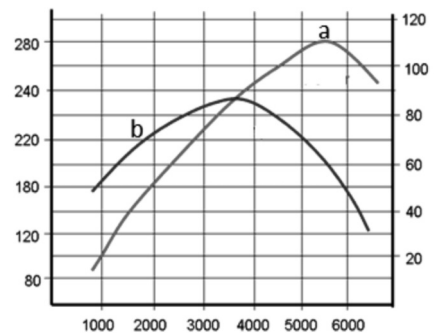


Figure 6

- 14 Engine output is tested on a dynamometer and the graph in Figure 6 is produced. What do the curves 'a' and 'b' represent?
- a a = power, b = rpm.
 - b a = torque, b = power.
 - c a = rpm, b = torque.
 - d a = power, b = torque.

15 Which one of the following exhaust gases will increase if the engine is running hot?

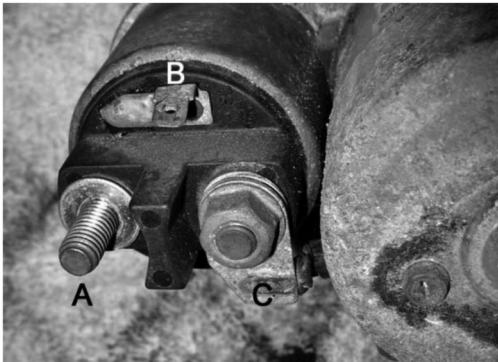
- a CO₂.
- b O₂.
- c CO.
- d NoX.

16 When added to water, anti-freeze will

- a lower the boiling point and raise the freezing point of the water
- b lower the freezing point and raise the boiling point of the water
- c lower the freezing point and keep the boiling point of the water the same
- d lower the boiling point and keep the freezing point of the water the same.

17 A charging system is tested and a voltage reading of 15.2 volts is recorded when the engine is at idle. What does this indicate?

- a The charging system is working and the battery is charged.
- b The charging system is working but the rectifier is faulty.
- c The charging system is working and the battery is discharged.
- d The charging system is working but the regulator is faulty.



<http://www.evolution.co.uk/info>

Figure 7

18 Figure 7 shows a solenoid. What is terminal A connected to?

- a The ignition switch.
- b The battery.
- c The starter motor.
- d The alternator.

19 If a voltmeter is connected across the battery terminals whilst the engine is cranked, the reading on the meter should **not** drop below

- a 12 volts
- b 10 volts
- c 5 volts
- d 1 volt.

20 An ammeter is connected in series with a 12 volt lamp and shows a current flow of 3 amps. What is the power rating of the lamp?

- a 4 watts.
- b 9 watts.
- c 15 watts.
- d 36 watts.

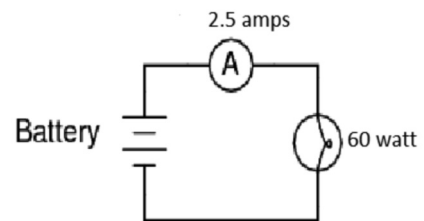


Figure 8

21 What is the battery voltage in the circuit shown in Figure 8?

- a 6 volts.
- b 12 volts.
- c 24 volts.
- d 150 volts.

22 A lamp is marked '12 V 60/65 W'. This means that

- a it is a single filament bulb that can be used for 60 W or 65 W output
- b the minimum and maximum range of output of the filament is 60 W or 65 W
- c it is suitable for either a 6 V or 12 V system
- d it is a double filament bulb, one of 60 W and one of 65 W output.

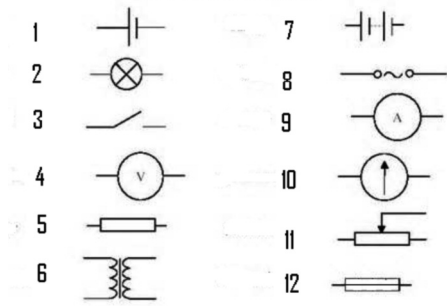


Figure 9

- 23 Which one of the following symbols, in Figure 9, represents a coil?
- a 6
 - b 8
 - c 10
 - d 11
- 24 If the electrolyte from a lead acid battery is spilt on the vehicle paintwork it should be removed using
- a a cloth
 - b brake cleaner
 - c cold water
 - d a detergent.

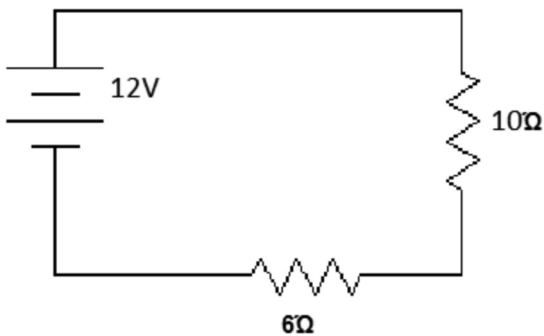
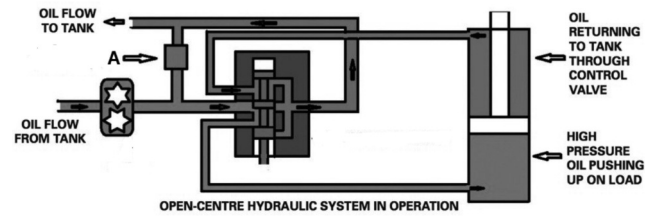


Figure 10

- 25 What type of circuit is shown in Figure 10?
- a Paralell.
 - b Chassis return.
 - c Series.
 - d Earth return.



<https://www.grainews.ca>

Figure 11

- 26 Which hydraulic component is indicated by A in Figure 11?
- a Hydraulic oil filter.
 - b Pressure relief valve.
 - c Hydraulic oil pump.
 - d Control valve.
- 27 What **main** precaution **must** be taken before starting work on a hydraulic system?
- a Drain the hydraulic oil.
 - b De-pressurise the system.
 - c Remove the hydraulic filter.
 - d Ensure it's at operating temperature.



<http://www.federalfp.com>

Figure 12

- 28 For which one of the following would the equipment in Figure 12 be used to check?
- a The hydraulic oil temperature.
 - b The hydraulic oil pressure.
 - c The hydraulic oil flow rate.
 - d The hydraulic oil viscosity.

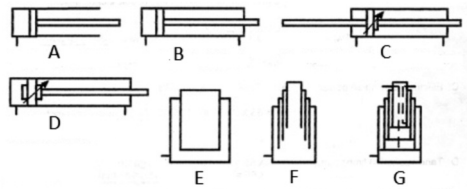


Figure 13

- 29 What does the symbol A represent in Figure 13?
- Single acting single rod cylinder.
 - Double acting double rod cylinder.
 - Double acting single rod cylinder.
 - Single acting double rod cylinder.
- 30 Which one of the following will **normally** be supplied with high pressure hydraulic fluid?
- Power take off.
 - Steering.
 - Transmission.
 - Trailer brakes.



Figure 14

- 31 What does the symbol in Figure 14 represent?
- A variable pump.
 - A fixed pump.
 - A fixed motor.
 - A variable motor.
- 32 Which one of the following is the **most** appropriate way to dispose of waste hydraulic oil filters?
- By an authorised company.
 - By putting in with general waste.
 - By incinerating with other filters.
 - By putting in a waste oil container.
- 33 Which one of the following creates flow in a basic hydraulic circuit?
- A hydraulic motor.
 - A hydraulic pump.
 - A hydraulic valve.
 - A hydraulic filter.

- 34 When an implement is attached to the tractor with the three point linkage, which link is connected last?
- Left.
 - Right.
 - Any.
 - Top.
- 35 Which one of the following tools is used to tighten bolts to the correct tightness?
- A ratchet spanner.
 - A ring spanner.
 - A torque wrench.
 - An air wrench.
- 36 When checking machinery for roadworthiness, which one of the following faults would make it illegal to drive on the road?
- The hydraulic oil level is low.
 - The flashing beacon is not working.
 - There is a red light showing to rear of vehicle.
 - The tyre tread depth is above the legal limit.
- 37 When storing machinery over winter, which one of the following would be a suitable action to take?
- Remove the anti-freeze from the coolant.
 - Raise it off the ground on axle stands.
 - Drain all of the oil from the machine.
 - Grease all of the brake linings.
- 38 How many satellite signals does a GPS receiver need to determine its position?
- 2
 - 4
 - 6
 - 8
- 39 When should the tyre pressures on an agricultural machine be checked?
- When they are cold.
 - When they are hot.
 - When they are low.
 - When they are warm.

- 40 Why should a turbo charged engine be allowed to idle before increasing the engine speed?
- To allow the oil pressure to increase.
 - To allow the boost pressure to increase.
 - To allow the exhaust gases to heat up.
 - To allow the inlet air to expand fully.

To answer questions 41-50 you must refer to Scenario 1.

Scenario 1:

A diesel tractor has been brought into the workshop for a service and it has been reported to be a poor starter, in cold conditions. The second fault reported is an intermittent non-starter in all conditions.

The following data is supplied to aid the technician.

Technical Data	
Engine	4 cylinder, 8 valve
Front wheel nut torque	200 Nm
Rear wheel nut torque	350 Nm
Valve clearances (cold) inlet	0.15 mm
Valve clearances (cold) exhaust	0.25 mm
Glow plug resistance	< 6 ohms
Fuel type	Diesel common rail
Fuel pressure	2000 bar
Air filter type	Twin paper element
Engine oil type	15W40
Engine oil and filter capacity	7.5 litres
Coolant capacity	8.52 litres
Anti-freeze percentage	25%
Battery	12 v maintenance free

- 41 During the service, the fuel filters must be changed. The technician makes a list of tasks, however two of these tasks are **not** required.

Which is the correct order of the tasks that the technician **must** carry out?

- Bleed the fuel system.
- Run engine and check for leaks.
- Remove the filter.
- Refit the filter.
- Pre-fill the new filter.
- Replace the seal.

- 3, 6, 4, 2
- 3, 1, 4, 6
- 5, 6, 4, 2
- 6, 3, 2, 5

- 42 To carry out a fuel pressure test, what does the technician connect the fuel pressure gauge to?

- The fuel filter.
- The fuel tank.
- The fuel rail.
- The fuel injector.

- 43 To test the condition of the battery, which one of the following is the **most** appropriate piece of equipment to use?

- A universal multimeter.
- A hydrometer.
- A high rate discharge meter.
- A refractometer.

- 44 Apart from the glow plugs, which one of the following checks is also necessary for the fault reported on this tractor?

- Alternator output.
- Anti-freeze strength.
- Correct choke operation.
- Grid heater operation.

- 45 After testing the glow plugs, the following readings were recorded. Which one of the following glow plugs is unserviceable?

- Number 1 = 6.5 ohms.
- Number 2 = 5.5 ohms.
- Number 3 = 5.0 ohms.
- Number 4 = 4.5 ohms.

46 **Statement 1**
The technician must set the rear wheel nut torque at 250 Nm.

Statement 2
The technician must set the anti-freeze quantity to 4.26 litres.

Which one of the following is correct for the statements above?

	Statement 1	Statement 2
a	True	True
b	True	False
c	False	True
d	False	False

47 Which one of the following would cause the second reported fault?

- a A faulty seat switch.
- b Transmission put into neutral.
- c The parking brake is engaged.
- d Independent brake pedals are latched.

48 Which tool should the technician use to adjust the valve clearances?

- a An internal metric micrometer.
- b An internal imperial micrometer.
- c A set of metric feeler gauges.
- d A set of imperial feeler gauges.

49 The technician uses a 2.5 litre oil jug to refill the engine.

Is this the correct choice of oil jug?

- a Yes, because it can be used 3 times to fill the engine to capacity.
- b No, because the engine oil does not need changing during the service.
- c Yes, because the engine should only be filled to 3.75 litres.
- d No, because jugs must not be used to fill the engine with oil.

50 What **must** the technician do to correctly service the air cleaner?

- a Change both filters.
- b Change the primary filter.
- c Change the secondary filter.
- d Clean both filters with paraffin.

NOW GO BACK AND CHECK YOUR WORK

- **IMPORTANT -**
Are the details at the top of the answer sheet correct?
Have you filled in your answers in INK in the appropriate boxes on the answer sheet?