



0171-523 MARCH 2022

Level 2 Technical Certificate in Land-Based Engineering

Level 2 Land-Based Engineering – Theory Exam

Tuesday 15 March 2022
09:30 – 11:30

You should have the following for this examination

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

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

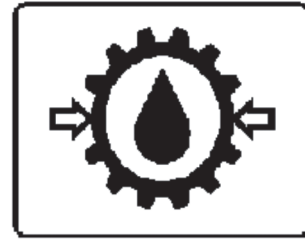
101	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
	Cancel	Cancel	Cancel	

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.

- 1 What is an advantage of a four-wheel drive (4wd) system over a two-wheel drive system?
- Reduced traction surface resistance.
 - Torque multiplication at traction surface.
 - Increased driven traction surface area.
 - Increased speed at traction surface.



www.manuals.deere.com

Figure 1

- 2 The **main** advantage of using tracks over wheels and tyres is the reduction in which of the following:

- Compaction.
- Surface area.
- Torque required.
- Maintenance.

- 3 Which belt would be **most** suitable for a high speed, high load drive system?

- Flat.
- Vee.
- Round.
- Serpentine.

- 4 Which of the following is a function of a differential?

- Increase speed and decrease torque.
- Increase torque and increase speed.
- Decrease torque and decrease speed.
- Decrease speed and increase torque.

- 5 Which tool is used to measure backlash within a differential?

- Dial test indicator.
- Torque gauge.
- Internal micrometer.
- Vernier gauge.

- 6 The warning light in Figure 1 represents transmission oil

- level
- pressure
- temperature
- flow.

- 7 When fitting wheels to a tractor, which tool is used to tighten wheel nuts/studs?

- A breaker bar and socket.
- An open-ended spanner.
- A combination spanner.
- A torque wrench and socket.

- 8 What is an advantage of a spark ignition two-stroke engine over a spark ignition four-stroke engine?

- Greater fuel efficiency.
- Higher power to weight ratio.
- Lower exhaust emission.
- Greater torque at low revs.

- 9 When rebuilding an engine with timing gears, which **two** components **must** be timed together accurately?

- Crankshaft and rocker shaft.
- Camshaft and rocker shaft.
- Camshaft and crankshaft.
- Crankshaft and oil pump shaft.

- 10 When fitting new valves to a cylinder head, the technician **must** lap the valves in. This is to ensure

- a liquid tight seal
- an air tight seal
- correct tappet setting
- correct valve lift setting.

- 11 When diesel fuel is injected into a cylinder from a mechanical diesel fuel system, the pressure is set by the
- injector pump
 - injector needle
 - injector spring
 - injector nozzle.
- 12 Which component transfers thrust from the piston to the crankshaft?
- The connecting rod.
 - The camshaft.
 - The rocker shaft.
 - The push rod.
- 13 An advantage of fully synthetic oil is a
- lower boiling point
 - reduced weight
 - high viscosity
 - longer service life.
- 14 What is the **main** method of reducing NOx in the emissions system?
- Inject diesel exhaust fluid.
 - Fit a diesel particulate filter.
 - Inject intake gases.
 - Recirculate liquid coolant.
- 15 Which engine component converts rotary motion into reciprocating motion?
- Camshaft.
 - Crankshaft.
 - Rocker shaft.
 - Balancer shaft.
- 16 Which tool is used to test the dilution of the coolant in a liquid cooling system?
- Dynamometer.
 - Multimeter.
 - Hydrometer.
 - Flow meter.
- 17 Before discharge testing a battery, what **must** be confirmed?
- Battery polarity.
 - Battery continuity.
 - Battery resistance.
 - Battery state of charge.
- 18 When charging a battery which explosive gas is produced?
- Nitrogen.
 - Hydrogen.
 - Oxygen.
 - Acetylene.
- 19 The heavy wire connected to an alternator will be connected to which terminal?
- B+.
 - B-.
 - IND.
 - Earth.
- 20 How **must** a headlight circuit always be wired?
- Series.
 - Series – parallel.
 - Parallel.
 - Parallel – series.
- 21 The digital multimeter reads OL when measuring the resistance between the starter motor main input terminal and the body of the starter. What does this mean?
- The brushes are in good condition.
 - The field and armature windings are in good condition.
 - The solenoid winding is broken.
 - There is a break in the field or armature windings.



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Figure 2

- 22 Which electrical component does the symbol in Figure 2 represent?
- A bulb.
 - A fuse.
 - A resistor.
 - A capacitor.

23 The unit of measurement for resistance is

- a Ohm
- b Volt
- c Amp
- d Watt.

24 When carrying out a high rate discharge test on a battery, what personal protective equipment (PPE) **must** be worn?

- a Ear defenders.
- b Breathing mask.
- c Safety goggles.
- d Helmet with visor.

25 What method is used for testing a bulb for serviceability?

- a Voltage test.
- b Specific gravity test.
- c High rate discharge test.
- d Resistance test.

26 Which of the following systems would a high pressure hydraulic circuit normally operate?

- a Transmission clutches.
- b Rear lift arms.
- c Lubrication circuits.
- d Diff-lock engagement.



Figure 3

27 Which hydraulic component does the symbol in Figure 3 represent?

- a Isolating valve.
- b Flow restricting valve.
- c Pressure relief valve.
- d Check valve.

28 When working with hydraulic oil, nitrile gloves should be worn to reduce the risk of

- a dermatitis
- b hand arm vibration
- c burning
- d impetigo.

29 When removing hydraulic pipes from a component, how should you prevent contamination entering the removed pipework?

- a Tie pipes up in the air with cable ties.
- b Seal hydraulic pipes with caps.
- c Support pipes in a drain tray.
- d Block pipes with paper towel.

30 What **must** a technician do after a scheduled service **and** before returning the tractor to a customer?

- a Ask the customer to pay the bill.
- b Check the customer's credit score.
- c Get the customer to sign the paperwork.
- d Show the customer the replaced parts.

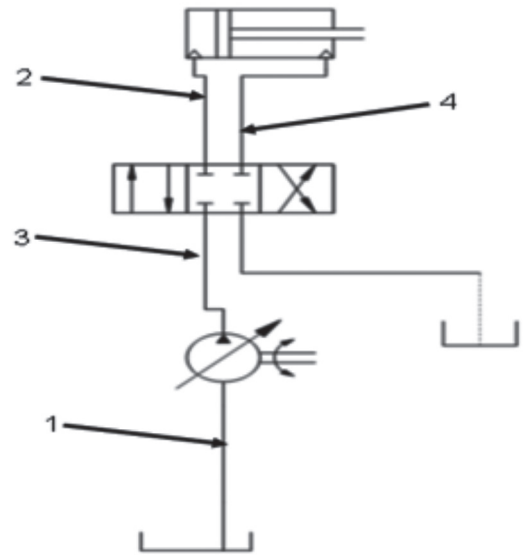


Figure 4

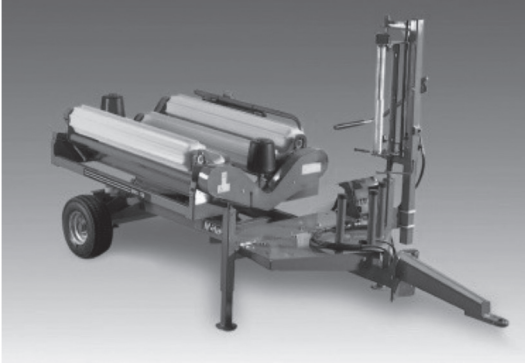
31 Where should a low pressure filter be placed within the circuit in Figure 4?

- a 1.
- b 2.
- c 3.
- d 4.

32 What is a possible cause of excessive pressure drop between a pump outlet and a control valve?

- a A worn pump.
- b A burst hose.
- c A worn motor.
- d A leaking cylinder.

- 33 Which of the following **must** a technician apply to the motor's components when rebuilding a hydraulic motor?
- a Rust inhibitor.
 - b Lubricating oil 10w30.
 - c Extreme Pressure (EP) 90 oil.
 - d Lubricating oil 46.



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Figure 5

- 34 The machine in Figure 5 is a
- a bale wrapper
 - b baler
 - c bale unwinder
 - d bale chopper.
- 35 The Provision and Use of Work Equipment Regulations 1998 (PUWER) requires that **all** equipment used in the workplace is
- a cleaned regularly for use
 - b maintained in safe condition for use
 - c only operated on business premises
 - d maintained by authorised service agents.
- 36 Where is the clutch pedal positioned in relation to the steering console, as viewed by a seated operator?
- a Upper right just under steering wheel.
 - b Lower right-hand side.
 - c Lower left-hand side.
 - d Upper left just under steering wheel.
- 37 What should the operator **always** complete before operating a tractor or machine?
- a Refueling process.
 - b Pre-start checks.
 - c Planned maintenance.
 - d Appropriate service records.

- 38 What factor has an influence on the stability of a tractor?
- a The seat position.
 - b The centre of gravity.
 - c The tractor horse power (hp).
 - d The Power Take Off (PTO) drive angle.
- 39 An operator has completed a day's work with a tractor. An orange warning light has appeared on the dash board. What should the operator's next step be?
- a Investigate fault and make an attempt at a repair.
 - b Report to line manager and complete the machine's maintenance log book.
 - c Park machine up and complete timesheet for the day.
 - d Remove the earth terminal to battery and report fault to colleague.
- 40 What is the safe method of operating a tractor with a rear mounted implement on a steep slope?
- a Reverse up the slope, drive down in low gear avoiding any sharp turns.
 - b Drive up the slope, turn at the top and drive down the slope avoiding sharp turns.
 - c Drive across the slope in low gear with low engine revs.
 - d Reverse up the slope and drive down in high gear with low engine revs.

Scenario 1

A technician has been asked to service a mower conditioner and report back to the service manager. The service manager has indicated that there have been issues with the performance of the implement, specifically the cutting quality and a high pitched noise from the conditioner.

The following technical information has been passed on to the technician:

The mower is driven by a 1000 rpm rated PTO shaft fitted with a slip clutch together with an over run function. The mower’s discs are all fitted with individual roll pins, designed to shear on impact with heavy objects.

The gearboxes are lubricated by Society of Automotive Engineering (SAE) 80w90 oil and use level plugs to ensure correct quantities of oil (full capacity at level or just below of plug hole). The information in Table 1 is provided for the gear box settings.

	Back lash setting	End float of input shaft
Gear boxes:1 & 2 90° drive	0.13 to 0.23 mm	0.11 to 0.17 mm

Table 1

The conditioner is driven by 3 Vee-belts which should be set to a total deflection of 0.4 to 0.7 mm, measured halfway between the driver and driven pulleys on the non tension pulley side of the drive.

- 41 The technician is running the mower to assist with fault diagnosis. Which PTO speed/range should the technician select?
- a 540.
 - b 540 Economy (E).
 - c 1000.
 - d 1000 Economy (E).
- 42 Given the complaints from the customer. What components should the technician replace on the mower?
- a The discs.
 - b The blades.
 - c The bed.
 - d The seals.

- 43 During the service the technician drains the oil from one of the 90° gear boxes. The oil recovered has metallic fillings within the oil. What should the technician do?
- a Replace drain plug and refill with new oil.
 - b Inform the customer of findings.
 - c Order a replacement gearbox.
 - d Inform the service manager of findings.
- 44 On rebuilding the gear box the technician adjusts the shims to get a reading of 0.09 mm of backlash. If one shim increases backlash by 0.01 mm how many additional shims are required to meet the **minimum** backlash specification?
- a 1.
 - b 2.
 - c 3.
 - d 4.
- 45 During the rebuild process the technician refills the gear boxes with oil.

Statement 1

The correct oil level is achieved by filling the gear box through the fill point. When the oil flows from the level plug hole, stop filling and insert the level plug to allow the oil to settle. Then remove the oil plug to drain off excess oil.

Statement 2

The correct oil level is achieved by filling the gearbox through the fill point. Once the oil flows from the level plug hole, stop filling and allow the oil to settle. When the flow from the level plug stops, insert the level plug to seal the gearbox.

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

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

- 46 Which components within the conditioner's drive line need to be replaced, based on the information supplied by the service manager?
- a The overrun clutch.
 - b The tine holders.
 - c The rotor bearings.
 - d The belt guard.
- 47 The technician is adjusting the Vee-belts to the manufacturer's specification. This is completed by
- a twisting belts between driven and idler pulley
 - b twisting belts between driven and driver pulley
 - c measuring deflection between driver and idler pulley
 - d measuring deflection between driver and driven pulley.
- 48 The technician carries out a functionality test in a field. The mower is **not** cutting an area of about 30 cm.
- What is the fault?
- a Sheared drive shaft.
 - b Sheared PTO shaft.
 - c Sheared splines.
 - d Sheared roll pin.
- 49 During the field test, smoke is seen coming from the PTO shaft when under load, which component requires adjustment?
- a Overrun clutch.
 - b Slip clutch.
 - c Dog clutch.
 - d Dual clutch.
- 50 Which of the following legislations **must** be adhered to during the service and repair of the mower conditioner?
- a The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR).
 - b Health and Safety at Work Act 1974 (HASWA).
 - c Lifting Operations and Lifting Equipment Regulations 1998 (LOLER).
 - d Working at Height Regulations 2005 (WAHR).

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?