

Qualification title: Level 2 Technical Award in Vehicle Technology (4292-20)

Exam title: Externally set, externally marked

Version: Sample

Base mark: 60

1

All vehicles have a range of power train, transmission and chassis layouts and designs. This is to satisfy the requirement of that specific vehicle design.

a) What is the power train and transmission layout shown in Figure 1? (2 marks)

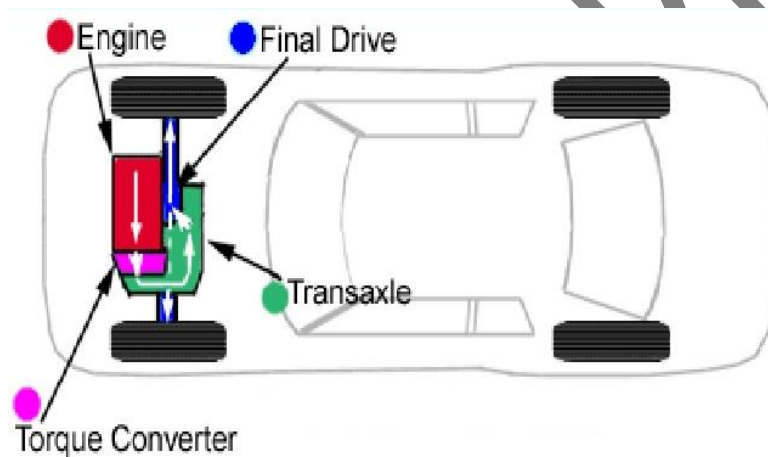


Figure 1

Answer

Transverse engine (1), Front wheel drive (1)

b) State **two** reasons why the power train and transmission layout in Figure 1 is used. (2 marks)

Answer

1 mark for any of the following, to a maximum of 2 marks.

- Allows compact layout
- increases passenger cabin space
- Fewer components required
- Improved traction on wet/icy surfaces
- Any other appropriate answer.

Test spec reference: 202 LO1 1.1

Total marks: 4 marks

With vehicle design, it is common for the front wheels to provide steering. However, drive can be transmitted in a range of ways.

A typical vehicle drive train layout is shown in Figure 2.

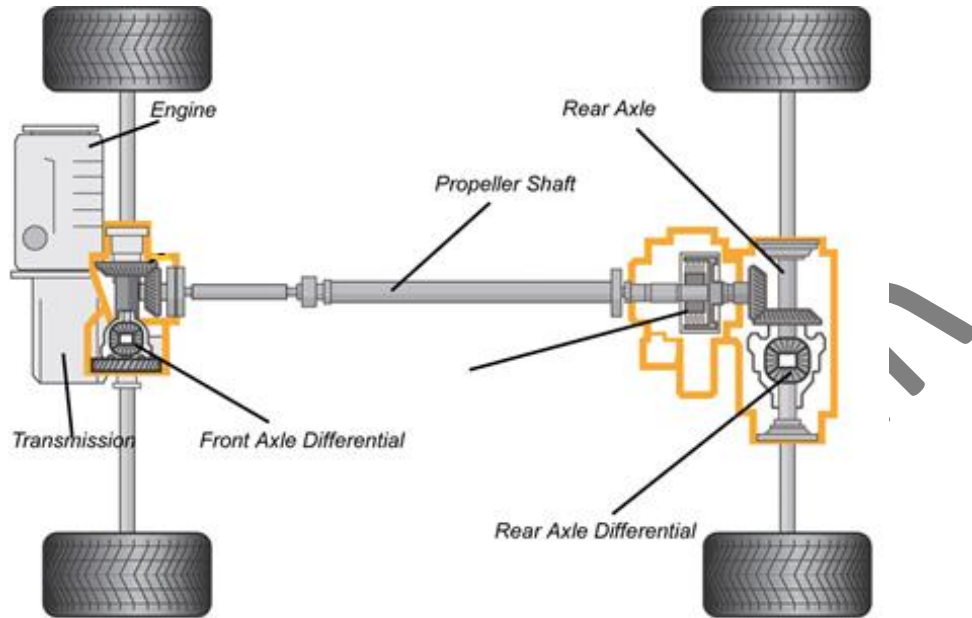


Figure 2

- a) How many wheels are driven in Figure 2? (1 mark)
 b) State **two** benefits of using the drive train layout in Figure 2. (2 marks)
 c) Name one type of drive train that can be used on a motorcycle. (1 mark)
 d) State **two** benefits of using the drive train identified in (c). (2 marks)

Answer

- a) Four wheel drive (1)
- b) 1 mark for any of the following, to a maximum of 2 marks:
- Improved traction
 - Improved stability
 - Reduce wheel slip
 - Drive can be split depending on road conditions
 - Any other appropriate answer.
- c) 1 mark for identifying any of the following and d) 1 mark for each benefit, to a maximum of 2 marks.

Chain (1)

Any two reasons from the following:

- Easy to adjust
- Provides a wide range of adjustment
- Light weight

Belt (1)

Any two reasons from the following:

- Low noise

- Minimal maintenance
- Light weight
- Reduce wear

Shaft (1)

Any two reasons from the following:

- No adjustment required
- Minimal maintenance
- Reduce power loss

Test spec reference: 202 LO1 1.2

Total marks: 6 marks

3

Different types of power train have different operating uses dependant on application.

State the correct operating cycle of a four stroke compression ignition (diesel) engine.

(4 marks)

Answer

Any appropriate description covering the below cycle in the correct order:

- Induction (1)
- Compression (1)
- Power (1)
- Exhaust. (1)

Test spec reference: 202 LO2 2.1

Total marks: 4 marks

4

a) Name one component used on vehicles for **each** of the following braking systems.

- Hydraulic.
- Compressed air.

(2 marks)

Answer

1 mark for any of the following:

i) **Hydraulic** braking components:

- Caliper
- Master cylinder
- Discs
- ABS modulator

1 mark for any of the following:

ii) **Compressed** air braking components:

- Brake chamber
- Air drier
- Actuator
- Compressor

b) For one of the braking systems listed in part a), describe its operation during normal braking.

(4 marks)

Answer

Hydraulic system operating principles: (1 mark for each of the following, to a maximum of 4 marks)

- Pressing pedal
- Master cylinder pressurising fluid
- Fluid actuating on the front and rear brakes
- Shoes/pads contacting drums/discs
- Any other appropriate operating principles can be accepted.

Compressed air system operating principles: (1 mark for each of the following, to a maximum of 4 marks)

- Compressor building air pressure when vehicle running
- Air tanks act as a reservoir
- Foot valve controls pressure to chambers/actuators
- Shoes/pads contacting drums/discs
- Any other appropriate description of operation during normal braking.

Test spec reference: 202 LO3 3.1, 3.2

Total marks: 6 marks

5

When working on vehicles, it is often necessary to take accurate measurements with different types of precision tools.

a) State **two** measurements that are needed when replacing a broken exhaust manifold stud. (2 marks)

b) State **one** tool which would be used to measure the replacement stud to ensure correct fitting. (1 mark)

c) Describe how to remove an exhaust stud that is broken flush in the cylinder head. (4 marks)

Answer

a) 1 mark for any two from the following:

- Diameter
- Length
- Pitch
- Thread depth
- Any other appropriate measurement.

b) 1 mark for any one tool from the following:

- Vernier gauge
- Rule
- Micrometer
- Pitch gauge
- Any other appropriate tool.

c) 1 mark for each of the following steps suitably described:

- Initially use a small size pilot drill bit to ensure centralisation
- Enlarge hole with appropriate size drill bit for stud extractor

- Use stud extractor to remove broken stud
- Re-tap thread using thread tap

Test spec reference: 202 LO4 4.1, 4.2

Total marks: 7 marks

6

a) When the vehicle is braking, the laws of physics will allow different braking forces to be available at each wheel. In order to test the operation of the brakes, the efficiency will need to be calculated.

A vehicle has a mass of 1200 Kg and moves with a velocity of 50m/s.

Calculate the brake force needed to stop the vehicle in 80 metres. (2 marks)

The following may be useful.

$$KE = 0.5 \times \text{Mass(Kg)} \times \text{Velocity(m/s)}$$

$$\text{Kinetic Energy (KE)} = \text{Force(N)} \times \text{Distance(m)}.$$

Answer

Kinetic Energy = 1500 KJ (1)

Brake Force = 18750 N (1)

b) State **four** factors that would increase the stopping distance of a vehicle. (4 marks)

Answer

1 mark for each of the following, to a maximum of 4 marks

- Tyre slip
- Loose surface
- Slippery surface
- Incorrect tyre pressure
- Ineffective brake system
- Vehicle speed
- Vehicle mass
- Any other appropriate answer.

c) Give **three** reasons why grey cast iron (ferrous) is used in the production of brake discs on light/heavy vehicles. (3 marks)

Answer

1 mark for each of the following, to a maximum of 3 marks.

Reasons:

- Easy to mass produce
- Low production costs
- Will not shatter
- Ease of design

d) State **two** properties of the fluid used in a vehicle's braking system. (2 marks)

Answer

Properties

1 mark for each of the following, to a maximum of 3 marks.

- Hydroscopic.
- High boiling point.
- The correct viscosity and good ability to flow at low temperatures.
- Wide operating temperature range.
- Low volatility.

Test spec reference: 201 LO1 1.2, 1.3 1.4

Total marks: 11 marks

7

Voltage, current and resistance in an electrical circuit are closely related. A change in one will affect the other two.

- a) i) Using Ohm's Law, calculate the resistance of a component with a 6 Volt supply and a current flow of 1.5 Amps. (2 marks)
- ii) What is the effect to the resistance if the voltage is increased to 24 Volts? (2 marks)

Answer

i) $6 = 1.5/R$ $R = 6/1.5$ $R = 4$ Ohms

ii) Resistance increases (1) by a factor of 4 (1).

- b) i) Describe the operating principles of the component shown in Figure 3. (3 marks)



Figure 3

- ii) Name **three** different types of starter motor. (3 marks)

Answer

i) 1 mark for any of the following, to a maximum of 3 marks:

- Converts mechanical energy in to electrical energy
- Rectifies Ac voltage to Dc voltage
- Regulates its output using a regulator
- Driven by a serpentine belt.

ii)

1 mark for each of the following, to a maximum of 3 marks:

- Bendix drive

- Inertia
- Pre-engaged
- Gear reduction
- Co-axial

Test spec reference: 201 LO2 2.2

Total marks: 10 marks

8

You have been tasked to recommend an appropriate engine drive train system to fit into a go-kart to compete in a race.

Propose a drive train system to use for the go-kart. Use a design plan to justify your answer. (12 marks)

Answer

Indicative content

Learners should select a suitable power train and transmission system. They are expected to explain the steps they would go through to decide on a suitable train and system – they should then justify this with appropriate reasoning.

Power unit

- Type of suitable engine – 2 stroke, 4 stroke
- Car/motorcycle/ATV/lawnmower
- Cylinders configuration– in-line/Vee/Multi/Single

Transmission type

- Manual
- Sequential
- Automatic
- CVT
- Integrated with engine or separate

Drive train

- Belt
- Chain
- Direct drive
- Drive shaft
- Differential

The learner must bring together the plan and describe in a cohesive manner why the selected design(s) are appropriate for the task.

Band descriptors

9-12 marks

The learner has produced a thorough build plan in a logical and professional manner. They show a thorough understanding of the build design process and have covered these in the correct logical order, including reasons behind component selection, the factors that need to be considered and the impact these factors may have on build choice and delivery. They have clearly understood how all the vehicle systems link to one another in terms of order and importance. They have provided valid reasons for their build proposal and have considered

factors such as price, efficiency, noise or the impact of these on the end-user (driver). Alternative solutions have been proposed including valid reasons behind why these were not chosen. The response is clear, coherent and all information has been presented in a logical order, including correct justifications behind proposals.

5-8 marks

The learner shows a mostly accurate understanding of the requirements of the question. They have identified and correctly described the process of designing the build plan and selecting the components for the power train but they have not appropriately linked all vehicle systems together to allow correct operation. They have an understanding of two or three key areas and have presented them in the correct logical order. They have considered alternative solutions to the one they have chosen. They have provided valid reasons for their build proposal but have not considered factors such as price, efficiency, noise or the impact of these factors on the end-user (driver).

1-4 marks

The learner shows a limited knowledge of the task or how to approach it. They have identified a very narrow range of factors to be considered. The approach to the task is unclear, lacking an understanding of following a correct logical order. They have provided limited detail of only one or two key areas (for example, have only focussed on the power unit to be used) but have not been able to link them as a whole to the other parts of the power train system. They have not considered alternative options. The response is unstructured and is not supported by sufficient reasoning or justification.

0 marks

No rewardable material.

Test spec reference: 202 LO1 1.1, 1.2
LO2 2.1, 2.2
201 LO1 1.1, 1.3

Total marks: 12 marks