



STUDENT NUMBER

CENTRE NUMBER

HIGHER SCHOOL CERTIFICATE EXAMINATION

1998

INDUSTRIAL TECHNOLOGY

2 UNIT

SECTION III—AUTOMOTIVE

*Total time allowed for Sections I, II and III—One hour and a half
(Plus 5 minutes reading time)*

DIRECTIONS TO CANDIDATES

- Write your Student Number and Centre Number at the top right-hand corner of this page.
- Where appropriate, show working for solutions neatly and clearly.
- You may use Board-approved drawing instruments and calculators.

Section III—Automotive (15 marks)

- Attempt ALL questions.
- Answer the questions in the spaces provided in this paper.

MARKER'S USE ONLY

Question		
13		
14		
15		

QUESTION 13. (5 marks)MARKER'S
USE ONLY

- (a) A pictorial drawing of a clutch pedal is given in Figure 1.
- Project an orthogonal front view of the pedal from the left side view drawn on the following page. Use the centre lines as a starting guide.
 - Add THREE major dimensions to the front view, using the appropriate drawing standards.

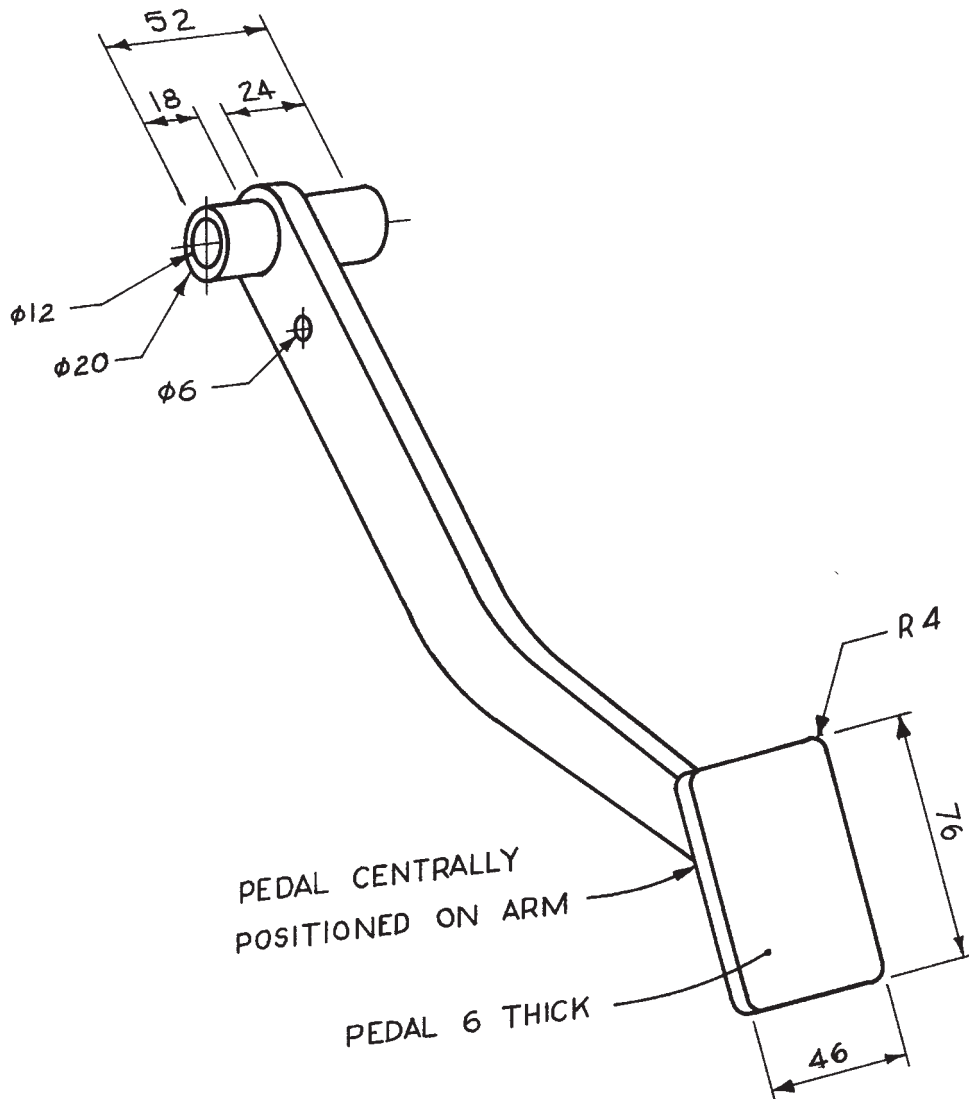
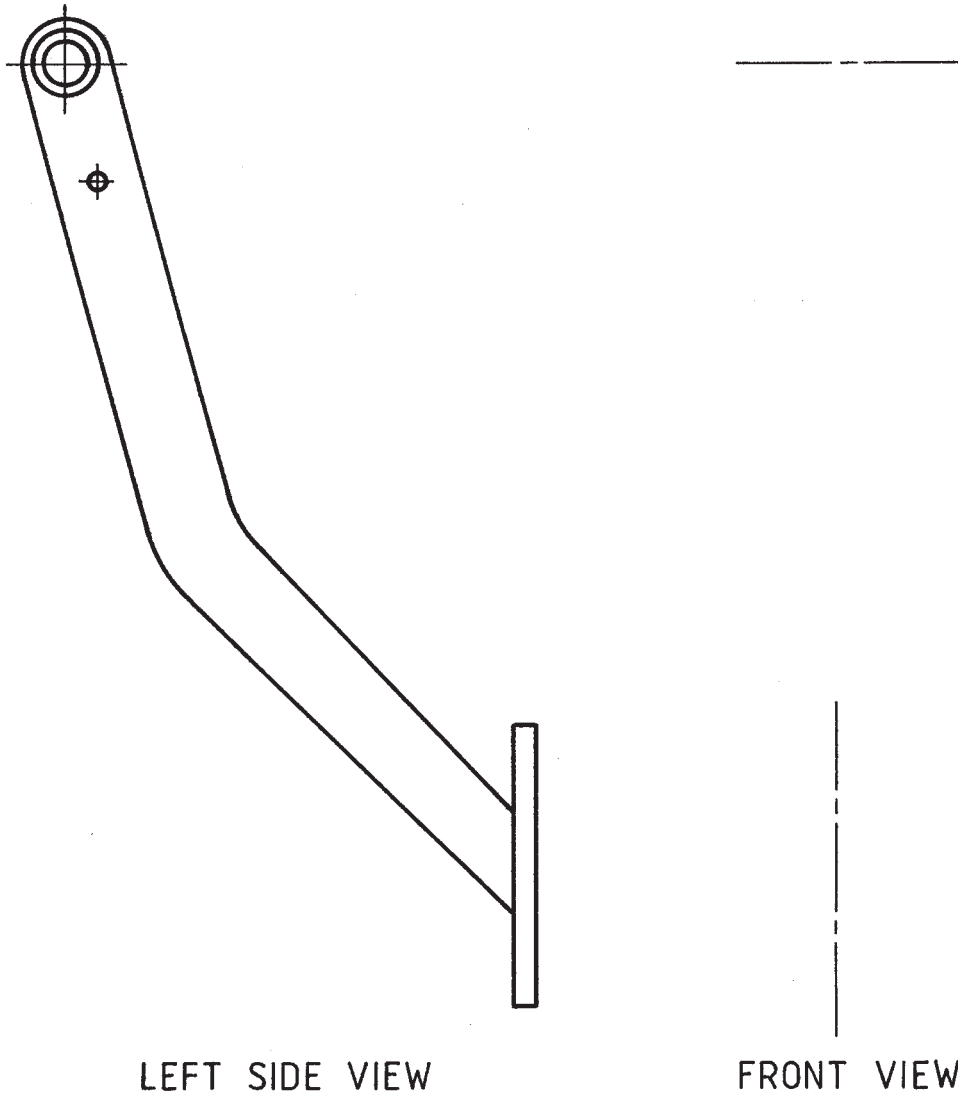


FIG. 1. CLUTCH PEDAL

QUESTION 13. (Continued)

MARKER'S
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LEFT SIDE VIEW

FRONT VIEW

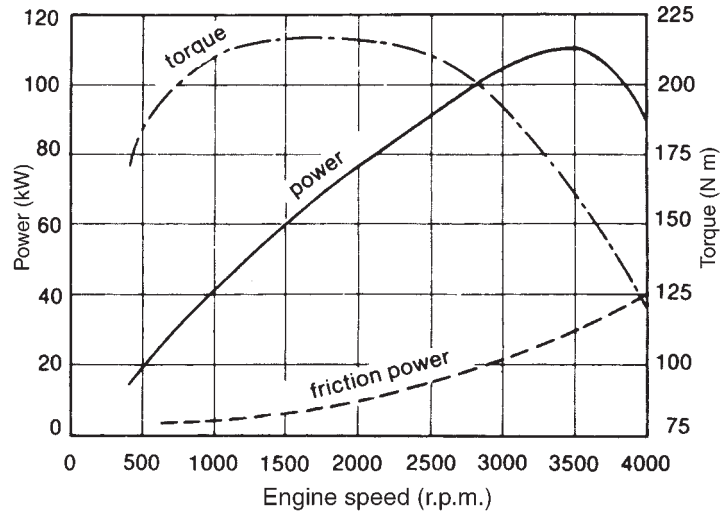
SCALE 1:2

Question 13 continues on page 4

QUESTION 13. (Continued)

MARKER'S
USE ONLY

- (b) A typical power/torque graph for an internal combustion engine is shown in Figure 2.



May, E and Crouse, W, *Automotive Mechanics*, McGraw-Hill Book Company, 1989, p 13

FIG. 2

- (i) Determine the maximum torque for this engine and give the speed at which it is developed.

Torque N m at r.p.m.

- (ii) Determine the speed for this engine that produces its best overall performance.

..... r.p.m.

- (iii) Identify one factor within the engine that may cause the significant drop in torque between 3000 and 4000 r.p.m.

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QUESTION 13. (Continued)

MARKER'S
USE ONLY

(c) Describe the purpose of a camshaft in a four-stroke internal combustion engine.

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(d) Explain what is meant by the term *clearance volume* within each cylinder of an engine.

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(e) Describe the purpose and one advantage of a hydraulic valve lifter.

Purpose

.....

Advantage

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(f) Many modern internal combustion engines have four valves per cylinder. Give ONE advantage of this innovation over a conventional system.

Advantage

.....

.....

(g) A computerised engine management system is made up of sensors, processors and actuators. Name ONE component in an engine that has a sensor attached to it for the management system. Briefly describe what information is gained from the sensor.

Name

Data

.....

QUESTION 14. (5 marks)

MARKER'S
USE ONLY



(a) Explain why cool air is injected into the exhaust manifold of some modern engines.

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(b) An extractor system is designed to improve engine scavenging. Explain what is meant by the term *scavenging*.

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(c) Give TWO reasons why it is not practical to have air-cooled high performance engines.

(i)

(ii)

(d) Give ONE advantage and ONE disadvantage for the use of liquid petroleum gas in motor vehicles.

Advantage

Disadvantage

(e) Explain briefly why a dynamometer is used in vehicle engine analysis.

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QUESTION 14. (Continued)

MARKER'S
USE ONLY

- (g) Engine performance may be improved by supercharging or turbocharging. Briefly explain the difference between these two methods.

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- (h) Describe how the driver of a vehicle might recognise that it has a badly worn front shock absorber.

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- (i) Name ONE steering alignment problem that would cause the two front tyres of a motor vehicle to wear badly on their inside edges.

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- (j) Give ONE reason why alternators have replaced generators (dynamos) in modern motor vehicles.

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- (k) Explain why the charging circuit of a motor vehicle is regulated to produce a voltage of 13.8 V when the system is based on an operating voltage of 12 V.

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- (l) Describe ONE safety precaution that must be taken when removing a radiator cap.

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- (m) Name the type of gears commonly used in the differential gears of a rear-wheel-drive vehicle.

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QUESTION 15. (5 marks)

The battery for a small sedan fits in the engine bay on a sheetmetal tray and against the bulkhead. The battery is 220 mm × 150 mm × 170 mm (high). One 6 mm mounting nut is welded in the bulkhead and two 6 mm holes are drilled in the tray. The arrangement is shown in Figure 4.

MARKER'S
USE ONLY

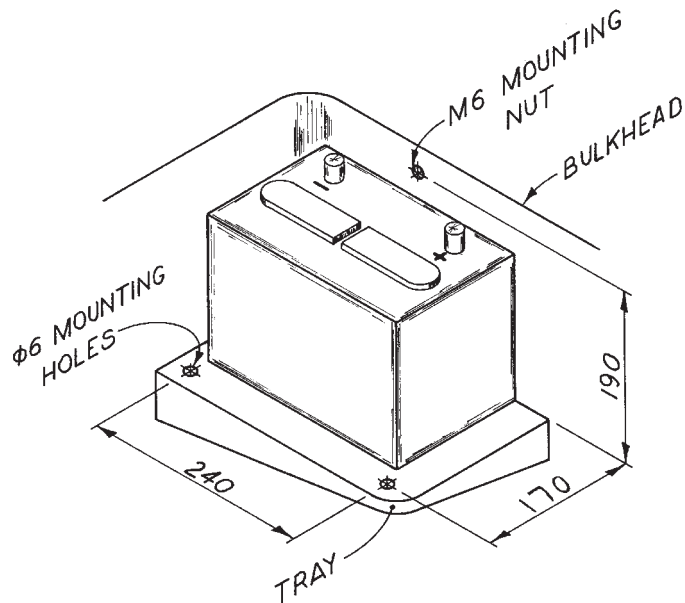


FIG. 4

- (a) Design a bracket that will firmly hold the battery in place using the mounting facilities shown in Figure 4. In the space provided on page 11:
- (i) draw a neat freehand pictorial sketch of your bracket design;
 - (ii) label the components of your bracket design;
 - (iii) indicate a suitable material and appropriate size for each component.

QUESTION 15. (Continued)

MARKER'S
USE ONLY

Question 15 continues on page 12

QUESTION 15. (Continued)

MARKER'S
USE ONLY

- (b) Describe the FOUR main steps that you would take to manufacture your design in part (a) in a school workshop. Name the main tools/equipment required for each step.

Step 1

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Tools/equipment required

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Step 2

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Tools/equipment required

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Step 3

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Tools/equipment required

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Step 4

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Tools/equipment required

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- (c) Describe briefly how you would protect your bracket from corrosion caused by battery acid.

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