 Province of the

EASTERN CAPE

EDUCATION

**DIRECTORATE SENIOR CURRICULUM MANAGEMENT (SEN-FET)**

**HOME SCHOOLING SELF-STUDY WORKSHEET ANSWER SHEET**

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| --- | --- | --- | --- | --- | --- |
| **SUBJECT** | Automotive | **GRADE** | 12 | **DATE** |  |
| **TOPIC** | Forces | **TERM 1****REVISION** | (Please tick) | **TERM 2 CONTENT** | (Please tick) |

**ACTIVITY 1**

A hoist steadily lifts an engine 2 meters up in 15 seconds. Given 500 kg as the mass of the engine.

 9.8 m/s2 as the gravitational force.

First determine the work done, which requires the force necessary to lift the car engine against gravity.

Calculate the power used to lift the engine.

Work done = Force x Distance

 = (500kg x 9.8 m/s2) x 2m

 = 4 900N x 2m

 = 9 800Nm or Joules

 = 9.8 kJ

Power is the rate or speed at which work is done, thus:

Power = $\frac{Work Done}{time (s)}$

 = $\frac{9 800J}{15 s}$ , **note** that 1 j/s is equal to 1 Watt (W)

 = 653.3 W

 or

=$\frac{9.8 kJ}{15 s}$

= 0.6533 kW

**ACTIVITY 2**

Given that a four stroke engine has a mean effective pressure on piston = 750 kPa

Length of stroke = 65 mm

Bore (cylinder diameter ) = 70 mm

Revolutions per minute = 3500

Number of cylinders = 4

 Calculate the indicated power

I.P = PLANn

P = 750 kPa

 **=** 750 x 1000 N/m2

L = 65 mm = 0,065 m

A = $\frac{πD²}{4}$

 = $\frac{π 0.007²}{4}$

N = 3500 ÷ 60 = 60 r/s

= 750 x 1000 x 0.065 x π .0072  x 60 x 4

 4 2

 = 22, 513 J/s

**ACTIVITY 3**

The brake power of an engine is 60 kW and the indicated power is 70 kW.

Calculate the mechanical efficiency of the engine.

Mechanical Efficiency = $\frac{Brake Power}{Indicated Power}$ x 100%

 = $\frac{60kW}{70kW}$ x 100%

=85.7%

**ACTIVITY 4**

The following data was recorded during a test carried out on a four-stroke, four-cylinder petrol engine:

Brake wheel diameter: 820 mm

Rope diameter: 20 mm

Brake dead weight: 765 N

Spring balance reading: 15 N

Speed during test: 1 200 r/min

Mean effective pressure: 800 kPa

Bore diameter: 110 mm

Stroke: 150 mm

Determine, by means of calculations:

a) Torque



b) Indicated power







c) Brake power in kW



d) Mechanical efficiency



**ACTIVITY 5**

Calculate the compression ratio of an engine with a bore of 80mm and stroke length of 90 mm. The combustion chamber volume is 50 cm3.

\*NB\* the unit for the bore size and the length of the stroke must in **centimetres** since clearance volume is in cubic centimetres (**cm3**)

CR = $\frac{SV +CV}{CV}$

and SV = $\frac{πD²}{4}$ x L

SV = $\frac{π8²}{4}$ x 9

 = 452,389 cm3

Therefore,

CR = $\frac{SV+CV}{CV}$

CR = $\frac{452. 389+50}{50}$

 C.R. = 10:1

**ACTIVITY 6**

The bore of an engine is 65 mm and the stroke length is 85 mm. The compression ratio is 8.5:1

 Calculate,

1. The swept volume in cm3

SV = $\frac{πD²}{4}$ x L

 = $\frac{π (6.5)²}{4}$ X 8.5

 = 282.06 cm3

b) The clearance volume in cm3

**Using Compression Ratio formula,** thus:

CR = $\frac{SV +CV}{CV}$

CR = $\frac{SV }{CV}$ + $\frac{CV }{CV}$

CR = $\frac{SV }{CV}$ + 1

CR - 1= $\frac{SV }{CV}$

8.5 – 1 = $\frac{282.06 }{CV}$

7.5 = $\frac{282.06 }{CV}$

Thus,

CV = $\frac{282.06 }{7.5}$

 = 37.6 cm3

**ACTIVITY 7**

The bore and stroke of an engine is 80 mm and 90 mm respectively. The compression ratio is 9,5: 1.

Determine, by means of calculations:

a) The swept volume in cm3



1. The original clearance volume in cm3

**Using Compression Ratio formula,** thus



c) The compression ratio is increased to 10: 1. What will the new diameter of the bore be if the clearance volume remains unchanged? Answer must be in mm.

