GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

TECHNIKA (MECHANICAL) SG

POSSIBLE ANSWERS OCT / NOV 2006

QUESTION 1

1.1.1 The symbol of the struggle around HIV/Aids (2)

1.1.2
- Videos
- Courses
- Advertising
- Training
- Speakers (5)

1.1.3
- Unsafe sex with an HIV positive person
- A needle shared with an HIV positive person
- Transmitted from an HIV positive mother to her unborn baby
- The blood of an HIV positive person entering your body through a cut on your skin (4)

1.2 1.2.1 ACME-screw thread (2)

1.2.2 29° (1)

1.2.3
- Where it is necessary to reduce backlash
- To transmit motion to slides and carriages e.g. machine-table screws
- To prevent seizing and fouling of the thread due to sagging e.g. long-lead screws
- Engaging mechanisms, such as the half-nut of a lathe
- For cross-slide screws, lifting jacks, and brake screws (3)

1.2.4 More economical to produce (2)

1.3 1/3/1 Square screw thread (2)

1.3.2 The pitch, P, of a screw thread is the distance from a point on a thread to a corresponding point on an adjacent thread, measured parallel to the axis of the screw. (3)

1.3.3 The lead of a screw thread is the distance that the nut will move along its axis, when turned through one complete revolution. The lead and the pitch of a single-start thread are equal. (3)

1.3.4 The angle ?, of a screw thread is the included angle formed between the sides of a thread. (3)

1.3.5 The depth, D, of a thread is half the difference between the major diameter and the minor diameter of the thread.

$$\text{Depth of thread : D} = \frac{D_2 - D_1}{2} \quad (3)$$

1.3.6 $$\text{Depth} = \frac{Pitch}{2}$$

$$= \frac{6}{2}$$

$$= 3 \text{ mm} \quad (6)$$

1.3.7 Where rapid motion is required. (2)

1.3.8
- Adjustment of change wheels
- Set over of compound slide
- Accurate slotted driving plate
- Graded driving plate. (4)

1.3.9
- Lead of screw thread
- Diameter of screw thread. (2)

1.4 No material removal. (2)

1.5 Material removal. (2)

1.6 No secondary processes. (2)

1.7 1.7.1 (a) Elastic limit
(b) Yield point
(c) Limit of proportionality (3)

1.7.2 For an elastic object the strain is proportional to the stress producing it, provided the limit of proportionality is not exceeded. (4)

1.8 1.8.1 1. Internal ring gear
2. Planetary carrier
3. Planet gear
4. Sun gear (4)

1.8.2 (a) The planet gear frame is connected to the output axle. One of the two components is closed and the third is driven. Reduction occurs at the planet. (4)

(b) When the planet gear frame is driven while the other two components are closed, an overdrive will occur at the third component. (4)

1.9 1.9.1 Moment = Force x perpendicular distance m

= 50 N x 0,7 m

= 35 Nm (4)

1.9.2 A system of forces is in equilibrium when the sum of the right-hand moment equals the sum of the left-hand moments around the same turning point. (4)

1.10 Tensile stress (2)

1.11 Shearing stress (2)

1.12 Compressive stress (2)

1.13 1.13.1 Working stress $= \frac{Ultimate\ stress}{Factor\ of\ safety}$

$= \frac{80}{4}$

= 20 MPa (3)

1.13.2 Stress $= \frac{F}{A}$

F = Stress x A

$= 20 \times \frac{\pi \ x \ 20 \ x \ 20}{4}$

F = <u>6283,18 N</u> (4)

1.13.3 Change in length = Strain x original length

$$= \frac{Stress}{E} \times 500$$

$$= \frac{20}{80 \times 10^3} \times 500$$

$$= \frac{10}{80}$$

Change in Length = 0,125 m (7)

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QUESTION 2

2.1

- Deafness: – noise
- Dermatitis (skin disease): – irritating substances and materials
- Tuberculosis: – insufficient ventilation
- Blindness: – insufficient safety precautions
- Heat exhaustion: – insufficient ventilation
- Poisoning: – insufficient control measures
- Radiation: – insufficient control measures (12)

2.2

- Well trained and intelligent
- Initiative
- Sound judgement
- Healthy human relations, be fair (4)

2.3 Planning, Guidance, Organising and Control (4)

2.4 Industrial housekeeping means a place for everything and everything in its place. It is necessary for:

- Saving time
- Saving space
- Preventing accidents
- Reducing fire hazards (5)

[25]

QUESTION 3

3.1 Fluid Area $= \frac{\pi \ x \ d^2}{4}$

$= \frac{3{,}142 \ x \ 0{,}54^2}{4}$

$= 229{,}022 \times 10^{-3} \ m^2$

$= 0{,}229 \ mm^2$

$P = \frac{F}{a}$

$F = P \times a$

$F = 9\,000\,000 \ Pa \times 0{,}229$

$F = 2\,061\,000 \ N$

$F = 2{,}061 \ MN$ (6)

3.2 Hydraulics is the transfer and control of power, by means of fluids. (3)

3.3 Pascal's Law

The pressure of a liquid in a constricted space e.g. a cylinder, will be distributed equally in all directions. (4)

3.4 Fluids are viscous i.e. they offer resistance to flow. Different fluids have different viscosities e.g. oil and water. (4)

3.5 For the **26H7 – g6** fit

3.5.1 The limits for a **26H7 – g6** hole shaft combination (4)

	Hole	**Shaft**
High	26 + 0,021 = 26,043 mm	26 – 0,007 = 25,993
Low	26 + 0 = 26,00 mm	26 – 0,02 = 26,980 mm

3.5.2 Type of fit : Clearance fit (1)

3.6 Cubic crystal, Pyramid crystal, Calcite crystal (3)
[25]

QUESTION 4

4.1.1 Work done = force x distance
= 200 N x 8 m
= 1 600 Nm
= 1 600 joule
= 1,6 kJ (4)

4.1.2 Work done = force x distance
= 42 N x 400 m
= 16 800 Nm
= 16 800 joule
= 16,8 kJ (4)

4.2.1 Average force in rope = force for lift + average force for rope

$$\text{F avg} = 480 \times 10 + \frac{(initial\ \ force + \ \ final\ \ force)}{2}$$

$$\text{F avg} = 4800 + \frac{(4200 + 0)}{2}$$

$$= 4800 + 2100$$

F avg = 6900 N (6)

4.2.2 Work done W = F avg x S

= 6900 x 180 m

= 1 242 000 J

= 1 242 kJ (3)

4.2.3 $\text{Power} = \frac{W}{t}$

$= \frac{1242\ kJ}{4\ x\ 60}$

$= 5{,}175\ \text{kW}$ (3)

4.3 A force should be applied.
There must be movement.
There must be resistance. (3)

4.4 Power is the rate at which work is done. (2)
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QUESTION 5

5.1 5.1.1 Propane (1)

5.1.2 Pentane (1)

5.1.3 Hexane (1)

5.1.4 Heptane (1)

5.1.5 Octane (1)

5.2 Boyle's law

The volume of a given mass of gas is inversely proportional to the pressure on it, if the temperature remains constant. (4)

5.3 Charles's Law

The volume of a given mass at constant pressure, changes by $\frac{1}{273}$ of its volume at 0°C for each 1°C change in temperature. (4)

5.4 The molecules are identical

- Distance between molecules is very big.
- Gas only takes up volume because of movement and collisions of molecules.
- No power between molecules except between collisions.
- Collisions are fully elastic. (5)

5.5 5.5.1

$$A = \frac{1P}{PLNn}$$

$$= \frac{115820}{946000 \; x \; 0{,}110 \; x \; 29{,}16 \; x \; 6}$$

$$= \frac{115820}{18206337{,}6}$$

$$\pi r^2 = 6361{,}521 \text{ mm}^2$$

$$r^2 = \frac{6361{,}521 \; mm^2}{\pi}$$

$$r = \sqrt{2024{,}93}$$

$$r = 45 \text{ mm}$$

$$d = 2 \text{ x } r$$

$$d = 90 \text{ mm}$$

. (7)

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TOTAL: 200