NAME $\qquad$
$\qquad$

- Write your name and index number in the spaces provided above.
- Answer ALL questions in section A and section B in the spaces provided
- Take Acceleration due to gravity $\mathrm{g}=10 \mathrm{~m} / \mathrm{s}^{2}$
- Mathematical tables and electronic calculators may be used.


## FOR EXAMINERS' USE ONLY

| SECTION | QUESTION | MAXIMUM <br> SCORE | CANDIDATE <br> SCORE |
| :---: | :---: | :---: | :--- |
| A | $1-12$ | 25 |  |
| B | $13-17$ | 55 |  |
|  | GRAND TOTAL | 80 |  |

## SECTION A(25 Marks)

1. The figure below shows a miciómeter screw gauge used to measure the diameter of a metal rod. When the rod is removed ardit the jaws of the micrometer screw gauge are closed, the reading is 0.12 mm . Determine the drameter of the rod. ( 2 marks)

2. Explain why it is advisable to use a pressure cooker for cooking at high altitudes. (2 marks)
3. The cross sectional area of cylinder B below is double that of cylinder A.


Determine the force F necessary to keep the system in equilibrium when a force of 20 N is applied as shown (ignore friction force) (3 marks)
4. The figure below shows a flask air tixghtly fitted with a glass tube dipped into a beaker containing water at room temperature.


State giving a reason what is observed when ice-cold water is poured on the flask. (2 marks)
5. Other than temperature state one other factor that affects the surface tension of water. (1 mark)
6. Explain why the smell of rotten eggs broken at one end of the room soon spreads throughout the room. (1 mark)
7. $200 \mathrm{~cm}^{3}$ of oxygen is collected at $27^{\circ} \mathrm{C}$ and 75 cm Hg . What is its volume at $0^{\circ} \mathrm{C}$ and 76 cm Hg ? (2 marks)
8. A bottle has a mass of 0.0185 kg a $\mathrm{i}_{\text {hen }}$ empty and 0.0425 kg when full of a liquid. If the bottle has a capacity of $2.0 \times 10^{-5} \mathrm{~m}^{3}$, calculate the density of the liquid in $\mathrm{g} / \mathrm{cm}^{3}$. (2 marks)

9. The fifgure below shows an athlete lifting weights while standing with the feet apart.


Explain why standing with the feet apart improves the athlete's stability. (1 mark)
10. An object of weight 20 N attached at the end of a spring causes an extension of 0.5 cm on the spring.
a) Determine the spring constant of the spring. ( 2 marks)
b) Determine the weight of an object that would cause an extension of 0.86 cm when attached at the end of the same spring. ( 2 marks)
11. The figure below shows a horizontal tube with two vertical tubes $x$ and $y$. Water flows through the horizontal tube from right'to left. The water level in tube x is higher than water level in tube y .


Explain the observation. (2 marks)
12. The weight of a solid in air is 5.0 N . When it is fully immersed in a liquid of density $800 \mathrm{~kg} / \mathrm{m}^{3}$, its weight is 4.04 N .

Determine
(a) The upthrust in the liquid. (1 mark)
(b) The volume of the solid. (2 marks)

## SECTION B (55 Marks)

13. a) What is a machine? (1 mark)
b) Two gear wheels have 80 teeth (doriven) and 20 teeth (driving) and lock with each other. They are fastened on axles of equal dianeters such that a weight of 150 N attached to a string wound one axle will just raise 450 N onst

(ii) Welocity ratio (2 marks)
(iii) Efficiency of the machine (2 marks)
c) The figure below shows a hydraulic press that is worked by applying a force of 80 N at the end of a lever 28 cm long pivoted at 4 cm away from the other end, the plunger being 4 cm from the pivot. The area of the piston $P$ is $2 \mathrm{~cm}^{2}$ and that of $Q$ is $10 \mathrm{~cm}^{2}$.


## Calculate the pressure exerted on the liquifín at P. (2 marks)


d) The graph below shows the variation of force with distance for a body being towed



Calculate the total work done on the body. (3 marks)
14. a) The figure below shows a velocity time graph for the motion of a certain body.


Describe the motion of the body in the region:
(i) $\mathrm{OA} \quad$ (1 mark)
(ii) AB (1 mark)
(iii) $\mathrm{BC} \quad$ (1 mark)
b) A car moving initially at $10 \mathrm{~ms}^{-1}$ decelerates at $2.5 \mathrm{~ms}^{-2}$.
(i) Determine;
I. Its velocity after 1.5 s . (2 marks)
II. The distance traveled in 1.5s. (2 marks)

(ii) Sketch velocity time graph for the motion of the car up to the time car stopped. (1 mark)
(iii) From the graph, determine the distance the car traveled before stopping. (2 marks)
15. a) State Newton's second law of motion and use it to define a unit force i.e. the Newton. (2 marks)
b) An arrow of mass 100 g traveling horizontally at $15 \mathrm{~m} / \mathrm{s}$ hits a block of wood of mass 400 g lying at rest on a smooth surface. Calculate.
(i) The common velocity after the impact. (2 marks)
(ii) The change in kinetic energy if the block is then struck by a second similar arrow traveling in the opposite direction but with hefzontal velocity of $12 \mathrm{~m} / \mathrm{s}$. (3 marks)
c) The figuresbelow is graph showing the velocity of a body plotted against time.

(i) Describe the motion of the body over

CD (1 mark)

DE (1 mark)

EF (1 mark)
(ii) What is the acceleration of the body over the region OB? (1 mark)

(iii)What is the ayerage velocity over the total journey? (2 marks)
(3) In an experiment to investigate the variation of centripetal force $F$ force with radius $r$ of a circle in which a body revolves the following results were obtained.

| Mass (g) | 60 | 50 | 40 | 30 | 20 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Radius $\mathrm{r}(\mathrm{cm})$ | 50 | 41 | 33 | 24 | 16 |

(i) Plot a graph of force F in Newton's against the radius r in metres. (7 marks)
(ii) Given that the mass of the body is 100 g use the graph to determine the angular velocity w . (3 marks)
(iii) State 2 applications of circular motion. (2 marks)
17. The figure below shows a hydrauliçpress used to compress a bale.

(i) Explain briefly how a force applied on the lever compresses the bale. (4 marks)
(ii) Given that area of piston B is $18 \mathrm{~cm}^{2}$ and that of piston A is $3.0 \mathrm{~cm}^{2}$ and a force of 2 N is applied to piston A , find the force produced on the larger piston. ( 2 marks)

