

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces at the top of answer paper or answer booklet provided.

Answer all questions in Section A and any five questions from Section B and Section C. Do not answer more than four questions in Section B and not more than four questions in Section C.

All working must be shown clearly.

Where necessary take $g = 10 \text{ ms}^{-2}$.

Electronic calculators may be used.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question. If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

This question paper consists of 13 printed pages and 3 blank pages.

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Section A [40 marks]

Mechanics and Statistics

Answer all questions in this section

1 (a) The time taken by nine athletes to complete a 100 metre race (to the nearest second) was recorded. The results were as follows:

13; 14; 11; 19; 20; 12; 14; 16; 18;

[2]

[2]

Calculate the

- (i) mean,
- (ii) standard deviation of the data.
- (b) **Table 1.1** shows the distances that 100 people travelled to a popular shopping mall.

Distance (d km)	Frequency
$0 \le d < 5$	5
$5 \le d < 10$	25
$10 \le d < 15$	28
$15 \leq d < 20$	23
$20 \leq d < 25$	17
$25 \le d < 30$	2

Table 1.1

(i) Complete the cumulative frequency table for the information in **Table 1.1** by finding the values of *a* and *b*.

distance (km)	≤ 5	≤ 10	≤ 15	≤ 20	≤ 25	≤ 30
cumulative frequency	5	30	а	81	b	100

- (ii) Using 2 cm to represent 5 km on the horizontal axis and 2 cm to represent 10 people on the vertical axis, draw a cumulative frequency graph using the information from the table in (i). [4]
- (a) A sprinter runs along a straight road passing through points A and B with speed 9 ms⁻¹ and 13 ms⁻¹, respectively. The sprinter's acceleration between points A and B is constant and equal to 0,4 ms⁻².

Find the

2

(i) time taken by the sprinter to travel from point A to B. [2]

[2]

- (ii) distance AB.
- (b) The velocity-time graph in **Fig. 2.1** shows the motion of a particle for a fifteen seconds interval.



Fig. 2.1

Calculate the

- (i) acceleration during the first 4 seconds, [1]
 (ii) total distance travelled during the 15 seconds, [2]
- (iii) average speed of the particle in km/h. [3]

(a) **Table 3.1** shows the number of candidates who passed with grade A in Mathematics, English and Science in a class.

Table 3.1

Subject	Mathematics	English Language	Science
number of students	30	50	40

(i) Calculate the size of angles that represent each subject on a pie chart.

[3]

[2]

[3]

[2]

- (ii) Using a radius of 4 cm, draw a pie chart to illustrate the data in **Table 3.1**
- (b) **Table 3.2** shows the distribution of marks in a test taken by 30 students.

mark	1 - 5	6 - 10	11 - 15	16 – 20	21 - 25
frequency	4	6	11	6	3

- (i) Calculate the mean mark.
- (ii) Find the mode and the median of the data.

4

(a) A particle moves in a straight line. Its distance, t seconds after leaving a fixed point A, is x metres, where $x = \frac{1}{2}t^2 + \frac{1}{15}t^3$.

Find the

(i) velocity after 5 seconds, [3](ii) acceleration after 5 seconds. [2]



Three coplanar forces act at a point. The magnitudes of the forces are 6N, 7N and 8N, and the directions in which the forces act are shown in Fig. 4.1.

Find the magnitude and direction of the resultant of the three forces. [5]

5

Section B: Mechanics

Answer not more than four questions in this section.

Each question carries 12 marks

5 A box of mass 500 kg is lifted vertically at a constant speed, by (a) a cable of a crane.

Find the

(i)	tension in the cable,	[1]
(ii)	power applied to the box in increasing the height by 30 m	
	in 50 seconds.	[3]

Particles A and B of masses 0,5 kg and 0,2 kg respectively are **(b)** attached to the ends of a light inextensible string. Particle A is held at rest on a horizontal table with the string passing over a smooth pulley at the edge of the table. Particle B hangs vertically below the pulley as shown in Fig. 5.1.





The system is then released from rest. In the subsequent motion a constant frictional force of magnitude 0,6 N acts on particle A.

Find the

(i)	tension in the string.	[6]
(ii)	speed of particle B, 1,5 seconds after it starts to move.	[2]

7 A girl runs from point X to a point Z. She stops at point Z and then walks **(a)** back towards point X until she reaches a point Y, where she stops. Fig. 6.1 shows the v - t graph where v m/s is the girl's velocity at time t and walks in the same straight line throughout.



Fig. 6.1

- (i) Find the distance XY and XZ.
- **(ii)** Sketch the graph of x against t where x metres is the girl's distance from X. Show clearly the values of *t* and *x* when the girl arrives at Z, when she leaves Z and when she arrives at Y. [3]

6

[3]

(b) The three coplanar forces shown in **Fig.6.2** act at a point **A** and are in equilibrium.



[6]

- 9
- In Fig. 7.1 particles P and Q of masses 3 kg and 2 kg, respectively, are **(a)** attached at the ends of a light inextensible string which passes over a smooth fixed pulley. Particle Q is held on the horizontal floor and particle P hangs freely. Particle Q is then released and the particles start to move vertically with constant acceleration of magnitude a m/s^2 .



(b)

(a)

8 (b)		Two p ground 15 m/s ground particl	particles M and N are projected vertically upwards from horizontal d at the same time. The speed of the projection of M and N are s and 9 m/s, respectively. The height of M and N above the d, <i>t</i> , seconds after projection, are h_1 m and h_2 m respectively. Both les come to rest after returning to the ground.	
		(i)	Find the set of values of t for which the particles are travelling in opposite directions.	[3]
		(ii)	At a certain instant, M and N are above the ground and 2 $h_1 = 5 h_2$.	
			Find the velocities of M and N at this instant.	[4]
9 (a)		Two b are 10	oodies each of mass 500 kg collide head on when their speeds m/s and 5 m/s.	
		If they	v stick together on impact, find	
		(i) (ii)	their combined speed. the loss in kinetic energy	[4] [4]
	(b)	(i)	A constant force acts in the direction of motion of a body of mass 3 kg. The force causes the body to increase speed from 5 m/s to 15 m/s in 3 seconds.	
			Find the constant force.	[2]
		(ii)	A tennis ball of mass 0,3 kg strikes a wall with a speed of 12 m/s. If the tennis ball bounces away from the wall with a speed of 9 m/s, find the impulse exerted on the ball.	[2]

Section C: Statistics

Answer not more than four questions in this section.

Each question carries 12 marks.

10 (a) A box contains 6 blue pens and 3 red pens. All pens are identical except for colour.

Two pens are drawn from the box one after the other, without replacement.

- (i) Draw a tree diagram to show the outcomes of the experiment. [2]
- (ii) Find the probability that the pens drawn

1.	are of the same colour,	[2]
2.	include at least one blue pen.	[3]

10 (b) Events A and B are such that P(A) = 0,2, P(B) = 0,6 and P(A and B) = 0,4.

State, giving a reason in each case, whether events A and B are

(i)	independent,	[3]
(ii)	mutually exclusive.	[2]

- 11 A bag contains 7 yellow balls and 3 black balls. Four balls are selected at random from the bag, one after the other, without replacement. Let X be the number of black balls selected.
 - (a) Show that

(i)
$$P(X = 0) = \frac{1}{6}$$
, [2]

(ii)
$$P(X = 1) = \frac{1}{2}$$
. [2]

(b) Construct a table to show the probability distribution of X. [4]

(c) Find the

- (i) mean, [2]
- (ii) variance of X. [2]

12	(a)	A spor 4 girls	ts committee of 5 students is to be chosen from 6 boys and .	
		In how	w many ways can this be done if there must be	
		(i)	3 boys and 2 girls in the committee,	[2]
		(ii)	more boys than girls in the committee.	[3]
		(iii)	3 boys and 2 girls and one particular boy refuses to be in the committee with one particular girl.	[3]
	(b)	The w the th	ord Z I M B A B W E includes the four consonants and ree vowels I, A and E.	
		(i)	Find the number of different arrangements using all the eight letters.	[2]
		(ii)	How many of these arrangements have a consonant at the beginning then a vowel.	[2]
13	(a)	(i)	State one condition which must be satisfied for a situation to be modelled by a binomial distribution.	[1]
		(ii)	In a certain town 28 % of the youths are unemployed.	
			If 14 youths are chosen randomly in this town, find the probability that fewer than 4 of the youths are unemployed.	[4]
	(b)	(i)	The random variable X is normally distributed. The mean is twice the standard deviation. It is given that $(P(X > 4,8)) = 0,8$. Find the standard deviation.	[4]
		(ii)	A normal distribution has mean μ and standard deviation σ .	
			If 600 observations are taken from this distribution, how many observations would be expected to be between $\mu - \sigma$ and $\mu + \sigma$?	[3]

Table 14.1					
Mass (kg)	41 - 50	51 - 55	56 - 60	61 - 70	71 - 75
Frequency	21	62	55	50	12

14 Table 14.1 shows masses of 200 boys, measured to the nearest kilogram. **(a)**

On graph paper	, draw a histogram	to represent the data in the table.	[5]
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- An index is made up by combining 5 items A, B, C, D and E whose **(b)** weights are 40, 20, 15, 15 and 10, respectively. The index set up in the year 1985 and the prices in Z\$ for the items were 120, 100, 110, 125 and 80 respectively. The prices in 1988 for the 5 items were 150, 126, 121, 175 and 120, respectively.
 - Calculate the price relatives using the given data with 1985 (i) as the base year. [4]
 - Using the weights for the 5 items, calculate the weighted (ii) index for price relatives for 1988, using 1985 as the base year.

[3]

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