

Candidate Name

Candidate Number

Centre Name

Centre Number

Paper 1:**Sample paper**

(2 hours)

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, you must have a soft pencil (preferably of type B or HB), a clean eraser and a dark blue or black pen.

INSTRUCTIONS:

- You must write your name, candidate number, centre name and centre number on the answer sheets in the designated spaces.
- Objective section consists of 25 questions, and it is essential that you attempt all of them.
- Each question has four options labelled A, B, C, and D. Select the option that you think is correct. Mark it on the multiple-choice answer sheet using a soft pencil.
- Attempt all the questions from subjective section using a dark blue or black pen.
- It is important to follow the instructions provided on the answer sheets.
- Do not use correction fluid.
- Avoid writing on any bar codes.
- You are allowed to use a calculator if needed.

INFORMATION:

- This paper has a total of 100 marks.
- In objective section there are 25 questions, each carries one mark. There is no negative marking for incorrect responses.
- Subjective section comprises of 75 marks
- The number of marks assigned for every question or its parts is indicated within brackets [].
- Rough work must be completed on this question paper.

OBJECTIVE SECTION:

[Total 25 marks]

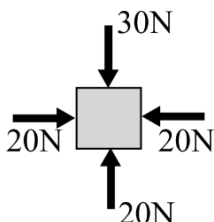
1 – [1]

Which of the following is a vector quantity?

- A) Speed
- B) Velocity
- C) Kinetic energy
- D) Charge

2 – [1]

What is the resultant force on the box shown below?



- A) 10 N down
- B) 30 N down
- C) 50 N down
- D) 90 N down

3 – [1]

Which of the following is a non-renewable source of energy?

- A) Nuclear
- B) Geothermal
- C) Biofuel
- D) Tidal

4 – [1]

An experiment is conducted to find the acceleration due to gravity on a 5 mm diameter steel ball falling a distance of 1m from rest. The time of fall is measured using a stop watch that measures to the nearest 100th of a second.

Which of the following would **not** increase the accuracy of the results?

- A) Dropping the ball a distance of 5m instead.
- B) Using light gates to measure the time instead.
- C) Using a stopwatch that measures to the nearest 1000th of a second.
- D) Using a high-speed video camera to record the experiment.

5 – [1]

A ray of light passes from air into a glass block at an angle of 53° to the normal.
If the refractive index of the glass is 1.6, what is the angle of refraction inside the block?

- A) 0°
- B) 22°
- C) 30°
- D) 53°

6 – [1]

Which of the following do **not** usually have a circular orbit?

- A) Asteroids
- B) Comets
- C) Moons
- D) Planets

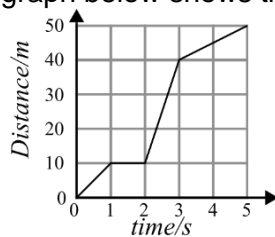
7 – [1]

When using a measuring cylinder, the correct volume is measured when:

- A) the meniscus is flat.
- B) the top of the meniscus is level with the mark.
- C) the middle of the meniscus is level with the mark.
- D) the bottom of the meniscus is level with the mark.

8 – [1]

The graph below shows the displacement of a car over the first 5 seconds of its journey.

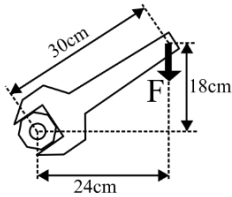


What is the maximum speed of the car during those five seconds?

- A) 50 m/s
- B) 30 m/s
- C) 10 m/s
- D) 9 m/s

9 – [1]

A plumber uses a spanner to loosen a stuck nut as shown below.



If the nut requires a moment of 760 Ncm to unstick it, what force does the plumber need to apply to the spanner?

- A) 26 N
- B) 32 N
- C) 43 N
- D) 76 N

10 – [1]

A red transparent film is used to change the colour of a white stage light by placing it between the light and the stage.

The film appears red from all directions because:

- A) Red light is reflected and other colours are absorbed.
- B) Red light is absorbed and other colours are reflected.
- C) Red light is reflected and other colours are transmitted.
- D) Red light is transmitted and other colours are absorbed.

11 – [1]

“Conservation of Energy” means:

- A) Less energy is used.
- B) Energy cannot be created or destroyed, only transferred.
- C) No energy is wasted.
- D) The energy comes from renewable sources.

12 – [1]

Puddles of water are always deeper than they appear to be. This is due to:

- A) diffraction.
- B) reflection.
- C) refraction.
- D) water not being 100% transparent.

13 – [1]

A supernova is an explosion so big that it briefly outshines all the stars in its galaxy. A supernova is produced when:

- A) a neutron star collapses into a black hole.
- B) a super giant has too much fusion happening in its core.
- C) a super giant star cannot fuse the iron produced in its core.
- D) a very large star moves off the main sequence and expands into a super giant.

14 – [1]

A TV uses 90 W of power and puts out 30 W of light, 40 W of sound and 20 W of heat. What is the efficiency of the TV?

- A) 78%
- B) 70%
- C) 100%
- D) 82%

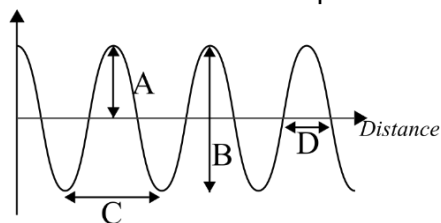
15 – [1]

A person stands on the surface of a thick fluid and starts to sink slowly. Which of the following statements is true?

- A) The pressure in the fluid under the person's feet is higher than next to them.
- B) The pressure in the fluid under the person's feet is lower than next to them.
- C) The vertical pressure in the fluid is higher than the horizontal pressure.
- D) The pressure is the same everywhere in the fluid.

16 – [1]

Which of these is the amplitude of a wave?



- A)
- B)
- C)
- D)

17 – [1]

A resultant force can cause an object to:

- A) speed up and change direction
- B) speed up, slow down and change direction
- C) speed up or slow down
- D) speed up, slow down, change direction or stop moving

18 – [1]

Two notes are played on a flute. The second note is louder and has a lower pitch. Which of the following statements about the second wave is true?

- A) The sound has a lower amplitude and a lower frequency.
- B) The sound has a higher amplitude and a shorter wavelength.
- C) The sound has a lower amplitude and a higher frequency.
- D) The sound has a higher amplitude and a longer wavelength.

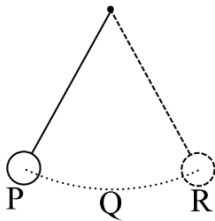
19 – [1]

A family travels by car from their home to the beach 60 km away. If the trip takes one hour, what is the average speed of the car in metres per second?

- A) 0 m/s
- B) 21 m/s
- C) 60 m/s
- D) 17 m/s

20 – [1]

A pendulum, shown below, starts at rest at P. The pendulum is allowed to swing freely.



Which of the following is the best way to measure the time period of a pendulum?

- A) Time from release at P to when it returns to P.
- B) Time ten complete swings starting from release at P, then take an average.
- C) After a few swings, time ten complete swings starting at P, then take an average.
- D) After a few swings, time ten complete swings starting at Q, then take an average.

21 – [1]

Which of the following shows the correct order of SI prefixes in increasing size?

- A) $\mu < m < n < k < M$
- B) $\mu < n < m < k < M$
- C) $n < \mu < m < k < M$
- D) $n < m < k < \mu < M$

22 – [1]

A car air bag reduces injury to the driver in a crash by:

- A) giving the driver's head something soft to hit.
- B) keeping the driver in their seat.
- C) increasing the time it takes the driver's head to come to a stop.
- D) decreasing the energy transferred away from the driver.

23 – [1]

A near by star has a spectrum which is blue shifted.

Which of the following statements about the star and the expansion of the universe does this observation suggest is true?

- A) The universe is not expanding and the star is moving towards us.
- B) The universe is expanding and the star is moving away from us.
- C) The star is moving towards us slower than the universe is expanding.
- D) The star is moving towards us faster than the universe is expanding.

As part of an experiment, the diameter of a long wooden cylinder is measured at five different points along its length with a micrometer. The results are shown in the table below:

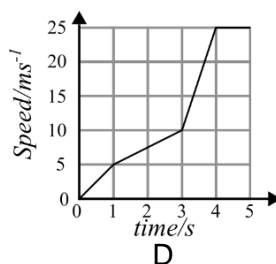
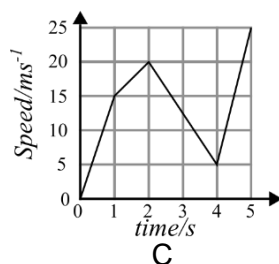
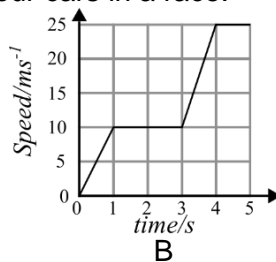
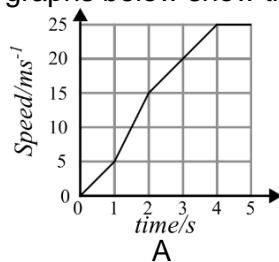
Measurement	Diameter /mm
1	12.70
2	12.25
3	12.70
4	12.95
5	12.65

What is the average diameter of the cylinder?

- A) 12.60
- B) 12.65
- C) 12.70
- D) 12.75

25– Motion, Hard, [1]

The graphs below show the velocity of four cars in a race.



After 5 seconds the order of the cars from furthest travelled to least travelled is:

- A) A > B > C > D
- B) (A, B and C are the same) > D
- C) C > (B and C are the same) > A
- D) A, B, C and D are all the same

26 – [2][3][4]

A small deep-sea exploration submarine has a mass of 12,000 kg and is constructed mostly of titanium.

1) a) A solid cube of titanium sinks in sea water. Explain how the submarine can float. [4]

b) The ideal average density of the submarine is 900 kg/m³. What is the volume of the submarine?

_____ m³ [3]

c) The Challenger Deep is the deepest part of the oceans at 11,000 m below the surface of the Pacific Ocean.

Assuming that the density of sea water is approximately 1000 kg/m³, what is the maximum pressure the submarine will need to withstand in order to reach the Challenger deep?

_____ Pa [2]

27 – Space [2][3][6]

The Sun is a main sequence star and so it is mostly made up of hydrogen.

a i) How does the Sun produce energy from that hydrogen? [1]

a ii) What conditions are necessary for this process to continuously produce energy? [1]

b) On average about 1.1 kW of power from the Sun reaches an area of 1 m² on the Earth's surface during the day.

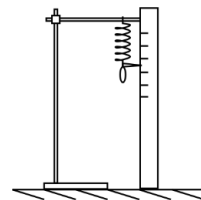
How much energy would fall on a 1 m² solar panel during 8 hours of daylight?

_____ MJ [3]

c) Describe the life cycle of the Sun once the hydrogen runs out. [6]

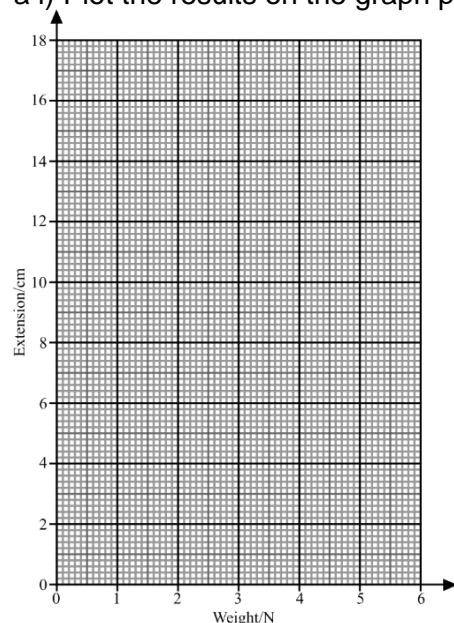
A spring with an unstretched length of 10 cm is hung vertically from a clamp stand as shown below.

The weight on the spring is increased and the extension of the spring is measured. The results are recorded in the following table:



Weight /N	Extension /cm
1.0	3.0
2.0	4.5
3.0	8.2
4.0	15.8
5.0	13.2
6.0	17.6

a i) Plot the results on the graph paper below and draw a line of best fit through the data. [3]



a ii) How much energy is stored in the spring when its length is 15 cm?
 _____ J [4]

b) The weight on the spring is increased further in order to find the point where the extension is no longer proportional to the weight.
 State and explain one safety precaution that should be used when performing this experiment. [2]

29 – [2][3][4][6]

A student conducts an experiment to find the terminal velocity of a steel ball falling in a measuring cylinder full of oil. The ball has a diameter of 8 mm and a mass of 2 g.

a) Explain how the steel ball reaches terminal velocity in the oil if it is released from rest just below the oil's surface. [6]

b) Explain how the student can be sure that the ball has reached terminal velocity. [3]

c) The time between releasing the ball below the surface of the oil and the ball falling 2 cm is measured as 0.17 s.
Over the course of that 2 cm, what is the average resistance force of the oil on the ball (drag and upthrust)? [4]

d) State Newton's 3rd Law and identify a third law pair of forces in this experiment. [2]

30 – [2][3][3][2]

a i) A teacher is conducting a demonstration of sound waves in a classroom, using a speaker connected to a signal generator.

If the speed of sound is 330 m/s and the signal generator is producing a wave with a frequency of 8500 Hz, what is the wavelength of the sound emitted from the speaker? [3]

a ii) The classroom has a door to the outside which is slightly open leaving a 2cm gap between it and the door frame. Will a student standing against the outside of the wall with the door in it be able to clearly hear the sound? Explain your answer. [2]

b) Electromagnetic waves are another type of wave.
State two similarities and two differences between sound waves and electromagnetic waves. [3]

c) Visible light is just one part of the electromagnetic spectrum.
State one region of the electromagnetic spectrum with shorter wavelengths than visible light, and state one danger caused by waves from that region. [2]

31 – [2][3][5]

A performer is practicing for a show by using a bow and arrow to shoot an apple off a pedestal 10 m away. The arrows have an average mass of 30 g, and the apples have an average mass of 110 g. The performer wants the arrow to strike the apple at the same speed each time.

a) State two things the performer should do to achieve this. [2]

b i) When released, the bowstring applies an average acceleration to the arrow of 14000 m/s^2 over a distance of 52 cm.

Show that the arrow leaves the bow with a speed of 120 m/s. [3]

b ii) The arrow collides with the stationary apple and sticks in it.

Assuming no friction between the apple and the pedestal, calculate how fast the apple and arrow move off to 2 significant figures?

_____ m/s [5]

32 – [2][3][6]

A rectangular block of transparent material is 10 cm long, 5 cm wide and 1 cm deep.

a) Describe an experiment to use a ray box and slits to accurately find the refractive index of the block. [6]

b) State and explain one means of improving the accuracy of your experiment. [2]

c) A second block of the same material is coated with a plastic film with a different refractive index in order to test the material's use in fibre optic cables. Explain how you would find the critical angle for total internal reflection for the coated block. [3]