HILLGROVE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2023
SECONDARY FOUR (EXPRESS)

CANDIDATE NAME ( ) CLASS

CENTRE NUMBER S INDEX NUMBER

PHYSICS 6091/01

Paper 1 Multiple Choice 28 August 2023

Additional Materials: Multiple Choice Answer Sheet 1 hour

8.10 AM to 9.10 AM

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

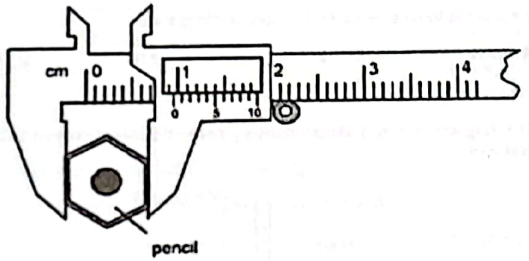
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

Setter: Mr Jonathan Ho

This document consists of 18 printed pages.

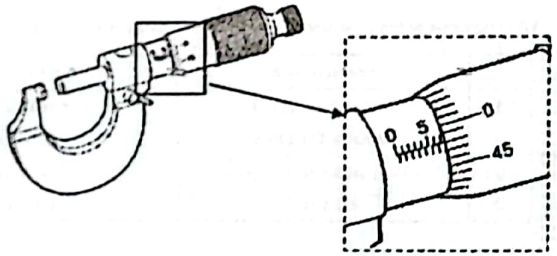
1 The thickness of a pencil is measured using vernier calipers.



What is the thickness of the pencil?

A 0.90 cm B 0.95 cm C 1.45 cm D 1.50 cm

2 The diagram shows a micrometer screw gauge.



What is the reading shown?

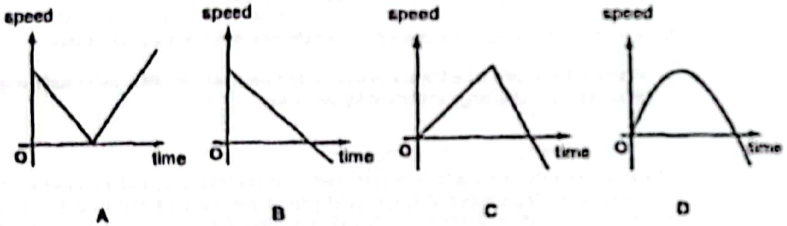
A 5.25 mm B 5.48 mm C 6.98 mm D 7.48 mm

3 Which instruments are most suitable for the accurate measurement of the thickness of a coin and the internal diameter of a test-tube?

	coin thickness	test-tube internal diameter
A	micrometer	micrometer
B	micrometer	vernier calipers
C	vernier calipers	metre rule
D	vernier calipers	micrometer

4 A stone is projected vertically upwards with an initial speed.

Which speed-time graph correctly shows the motion of the stone?



5 A skydiver falls from rest through the air and eventually reaches terminal velocity.

What is the acceleration of the skydiver during his fall?

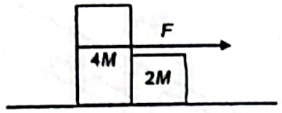
A constant at 0 m/s²

B constant at 10 m/s²

C starting at 0 m/s² and increasing to 10 m/s²

D starting at 10 m/s² and decreasing to 0 m/s²

6 Two blocks with masses $4M$ and $2M$ are pushed along a horizontal frictionless surface by a horizontal applied force F as shown below. During the motion, both blocks exert equal and opposite forces on each other.



What is the magnitude of the force acting on mass $2M$?

A $F/3$ B $F/2$ C $2F/3$ D F

7 The total weight of a gas-filled balloon is 2000 N. The balloon rises at an acceleration of 80 m/s².

What is the total upward force acting on the balloon?

A 2000 N B 16000 N C 18 000 N D 162 000 N

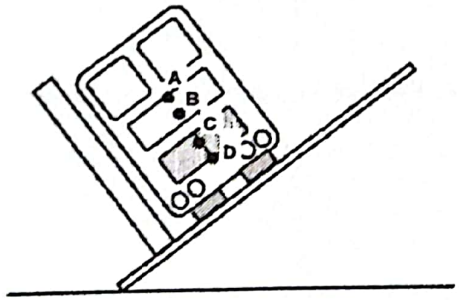
8 The densities of two metals are 7.6 g/cm³ and 3.0 g/cm³ respectively. The metals of equal masses are melted and mixed to form an alloy.

What is the density of the alloy?

A 1.25 g/cm³ B 2.15 g/cm³ C 4.30 g/cm³ D 5.30 g/cm³

9 The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is tilted such that it is just about to topple over.

Where is the centre of gravity of the bus?

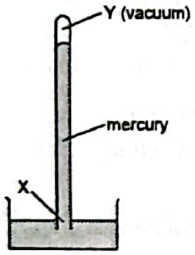


10 A garden table weighs 40 N and has a top surface of area 2 m². It is raining and the rain exerts a pressure of 4 N/m² on the table.

What is the force exerted by the table on the ground?

A 20 N B 32 N C 42 N D 48 N

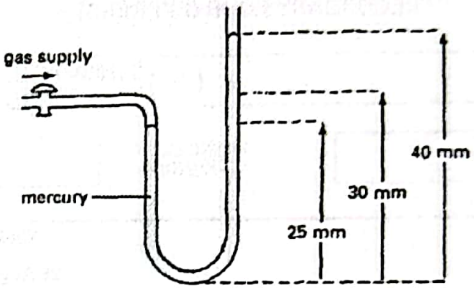
11 The diagram shows a simple mercury barometer which is used to measure atmospheric pressure.



What happens to the pressure at X and Y when atmospheric pressure increases?

	pressure at X	pressure at Y
A	remains the same	remains the same
B	remains the same	increases
C	increases	increases
D	increases	remains the same

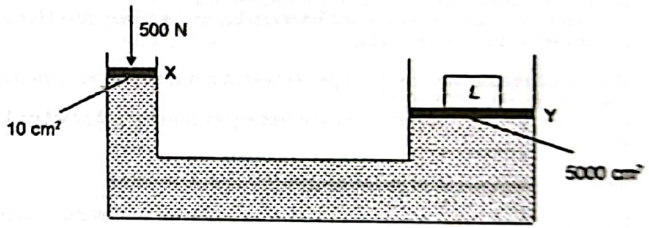
12 A mercury manometer is connected to a domestic gas supply and the level of the mercury in the right-hand limb rises as shown.



Assuming atmospheric pressure to be 760 mm Hg, what is the gas pressure in mm Hg?

A 720 B 765 C 770 D 775

13 The diagram below shows a hydraulic system.



A force of 500 N is applied on piston X of cross-sectional area 10 cm².

What is the load *L* on piston Y that can be raised?

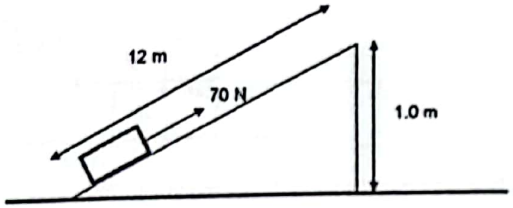
A 1.0×10^0 N

B 1.0×10^2 N

C 2.0×10^4 N

D 2.5×10^5 N

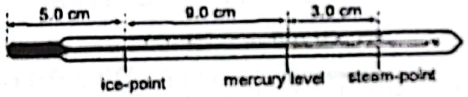
14 The diagram shows a block of mass 30 kg being pulled 12 m up a rough inclined plane at a constant speed by a force of 70 N.



What is the work done required to overcome friction?

A 300 J B 360 J C 540 J D 840 J

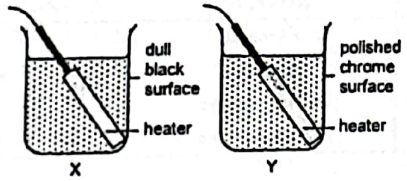
15 The ice-point and the steam-point are marked on an uncalibrated mercury thermometer as shown.



What is the temperature when the mercury level is at the position shown?

A 64.3 °C B 75.0 °C C 82.4 °C D 90.0 °C

16 In the diagram, two copper cans X and Y with outer surfaces of different textures are filled with same amount of water at room temperature and heated by heaters of same power.



Which of the following statements is correct?

A Water in X boils faster because dull black surface is a good absorber.

B Water in X boils faster because dull black surface is a better insulator.

C Water in Y boils faster because polished chrome surface is a poor emitter.

D Water in both cans take the same time to boil because texture of outer surface does not affect the rate of energy absorbed by the water.

17 The e.m.f. of a thermocouple with one junction P in melting ice and the other junction Q in steam is 12.0 mV. Junction P is removed from the melting ice and placed in a liquid at a constant temperature θ while junction Q is removed and placed in water at a constant temperature of 50 °C. The e.m.f. is now −2.4 mV.

What is the temperature θ?

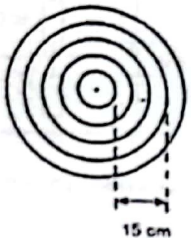
A 20 °C

B 30 °C

C 70 °C

D 120 °C

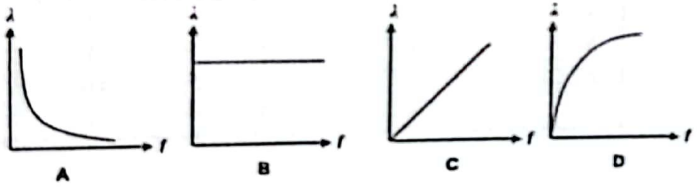
18 In a ripple tank experiment, the pattern of circular water waves is captured by a stroboscope as shown.



If the dipper is vibrating at 10 Hz, what is the wavelength and velocity of the waves?

	wavelength / cm	velocity / m/s
A	3	0.3
B	5	0.5
C	5	1.5
D	15	1.5

19 Which graph correctly shows the variation of wavelength λ against frequency f of electromagnetic waves in a vacuum?



20 The figure below shows part of the electromagnetic spectrum.

Which of the following statements is/are true?

infra-red	P	Q	X-rays

I Q can be deflected by an electric field.

II The frequency of P is smaller than that of Q.

III The velocity of P in a vacuum is smaller than that of Q.

A I only B I and II only C II only D II and III only

21 Below are four statements about the uses of electromagnetic radiation.

I) Gamma rays are used in medical treatment.

II) Infra-red waves are used in sunbeds.

III) Microwaves are used in satellite television.

Iv) X-rays are used in intruder alarms.

How many of these statements are correct?

A 1 B 2 C 3 D 4

22 A scientist uses echo sounding to measure the depth of an ocean. Ultrasound that travels at a speed of 320 m/s in air is sent vertically down and the reflected signal is picked up 8 s later. It is given that sound waves travel 4.0 times faster in water than in air.

What is the depth of the ocean?

A 1280 m

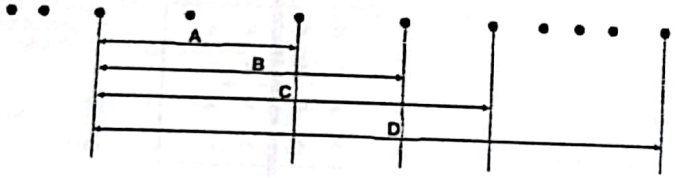
B 2560 m

C 5120 m

D 10240 m

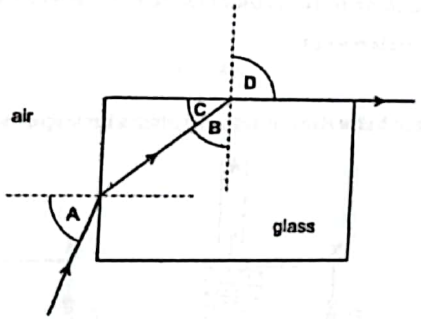
23 A sound wave passes through air. The diagram represents the arrangement of air molecules at one instant.

Which distance is the wavelength of the sound wave?



24 Light travels through a glass block as shown.

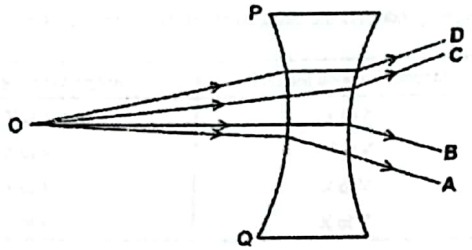
Which angle is the critical angle for light in the glass?



25 Four light rays from a point O enter a diverging lens.

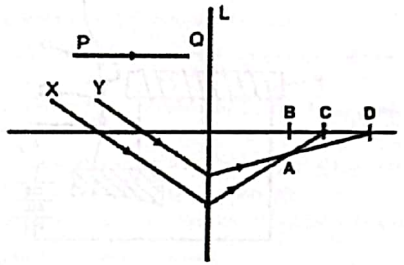
The face PQ of the diverging lens is part of a circle. O is the centre of this circle.

Which ray follows the correct path?

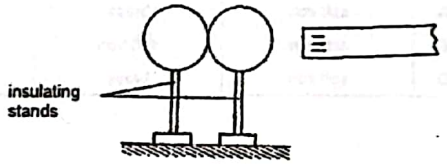


26 The diagram shows two incoming parallel rays of light X and Y, which pass through a converging lens, L.

Which point will ray PQ pass through after passing through the lens?

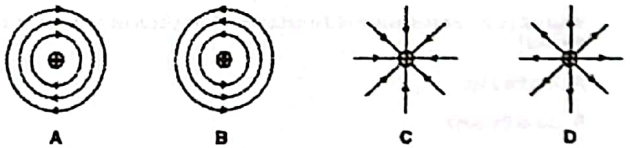


27 The diagram shows a negatively charged rod close to two conducting spheres mounted on insulating stands. The spheres are in contact.

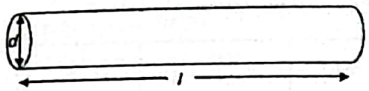


Which diagram shows the distribution of charges on the spheres?

28 Which diagram correctly illustrates the electric field around a positive point charge?



29 The diagram shows a segment of a uniform copper wire with length *l* and diameter *d*.



Which one of the following changes will cause the resistance of the wire to increase by four times?

A increase the diameter to 2*d* and increase the length to 4*l*

B increase the diameter to 2*d* and decrease the length to *l*/2

C decrease the diameter to *d*/2 and decrease the length to *l*/2

D decrease the diameter to *d*/2 and keep the length unchanged

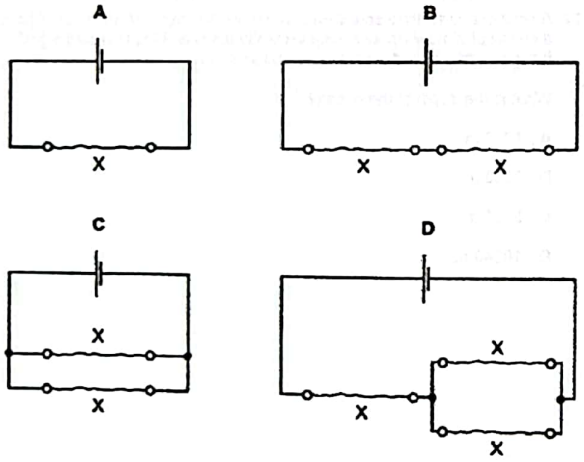
30 The total energy dissipated in a circuit when a charge of 15 C flows from the battery is 180 J.

What is the e.m.f. of the battery?

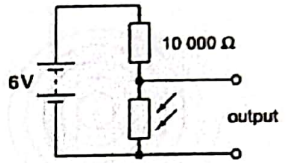
A 8.3 V B 12 V C 24 V D 2700 V

31 The circuit diagrams show identical pieces of resistance wire X connected to the same cell in different ways.

In which circuit will the cell lose its energy the fastest?



32 A potential divider consists of an LDR and a resistor connected to a 6 V battery.



What should be the resistance of the LDR for the output to be 3 V?

A 0 Ω

B between 0 and 10 000 Ω

C 10000 Ω

D more than 10000 Ω

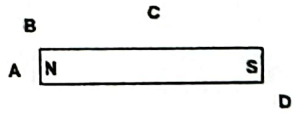
33 An electric heater is connected to a 3-pin socket. The current in the live wire is 1 A. The potential difference between the live and neutral wire is 240 V.

Which row correctly describes the current in the neutral wire and the potential difference between the neutral and earth wire?

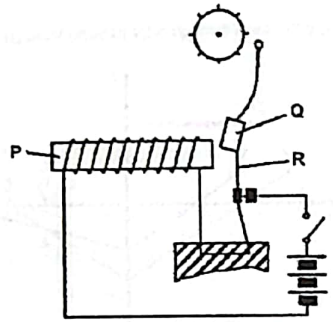
	current in neutral wire / A	potential difference between earth wire and neutral wire / V
A	0	0
B	1	0
C	1	240
D	0	240

34 A compass placed near a magnet is deflected as shown below.

Which of the following is the most likely position of the compass?



35 The diagram shows an electric bell.



What materials would be suitable for the parts labeled P, Q and R?

	P	Q	R
A	brass	soft iron	steel
B	soft iron	brass	soft iron
C	soft iron	soft iron	steel
D	soft iron	brass	copper

36 The figure shows a beam of electrons entering a magnetic field.

What will be the initial direction of the deflection of the electrons as the beam passes through the field?

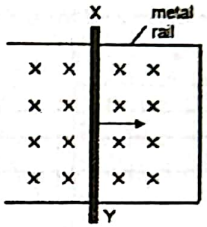
A into the page

B out of the page

C towards the bottom of the page

D towards the top of the page

37 In the diagram below, a metal rod XY is moved in the direction shown by the arrow along a metal rail in a magnetic field. An induced voltage is set up across XY.



Which statement is correct?

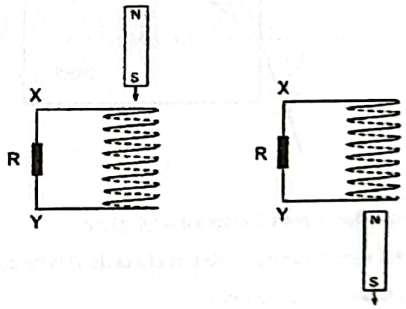
A An induced current flows from X to Y.

B An induced current flows from Y to X.

C An induced current flows from Y to X and then reverses direction.

D No current is induced.

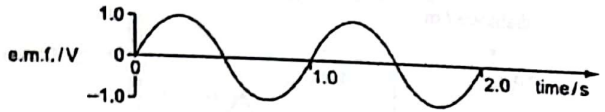
38 The diagrams below show the set-up for which a bar magnet is dropped through a coil of wire.



Which row correctly indicates the direction of the induced current through the resistor, R?

	magnet entering the coil	magnet leaving the coil
A	X to Y	X to Y
B	X to Y	Y to X
C	Y to X	X to Y
D	Y to X	Y to X

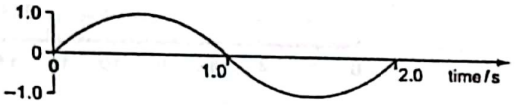
39 A simple a.c. generator produces an alternating e.m.f. as shown.



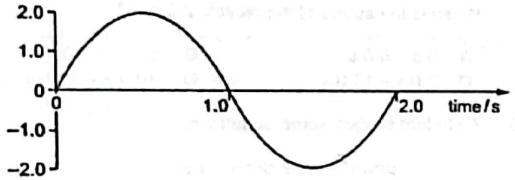
The speed of the generator is doubled.

Which graph best represents the new output?

A

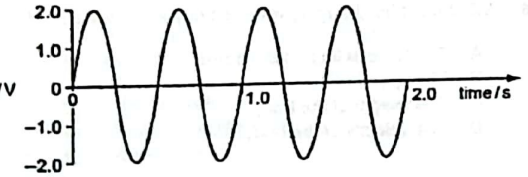


B



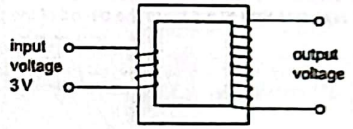
C

D



40 A step-up transformer with 100% efficiency has an input voltage of 3 V and an input current of 2 A.

Under these conditions, what output voltage and output current could be obtained?



	output voltage / V	output current / A
A	1	3
B	2	6
C	4	1
D	6	1

END OF PAPER

Hillgrove Secondary School
Sec 4 Prelim Examination 2023

MCQ

1	B	6	A	11	D	16	C	21	B	26	B	31	C	36	C
2	D	7	C	12	D	17	C	22	C	27	D	32	C	37	B
3	B	8	C	13	D	18	B	23	D	28	D	33	B	38	C
4	A	9	C	14	C	19	A	24	B	29	D	34	C	39	D
5	D	10	D	15	B	20	C	25	C	30	B	35	C	40	D