Name:	Class:	Register No:

DUNEARN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2023

PHYSICS **6091 / 01**
SECONDARY 4 EXPRESS

12 September 2023 (Tuesday) **0815 - 0915** **Paper 1** **1 hour**

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

There are forty questions in 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 paper.

Setter: Ms Yvonne Tan

This question paper consists of 17 printed pages including the cover page.

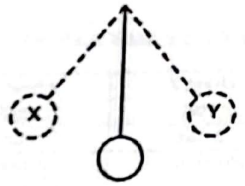
1 Which of the quantities are classified correctly under scalar and vector?

	scalar	vector
A	acceleration	time
B	friction	speed
C	latent heat	velocity
D	velocity	displacement

2 What is the order of magnitude of the diameter of an atom?

A 10^{-1} cm B 10^{-3} mm C 10^{-5} μm D 10^{-7} ns

3 A pendulum swings from X to Y and back to X again twenty times in 37.4 s.



What is the period of the pendulum?

A 0.534 s B 0.935 s C 1.87 s D 3.74 s

4 An object X of mass *m* is released from a height *h*. Above object X, another object Y of mass 2*m* is released from a height 2*h* simultaneously.

If both objects fall freely, which statement is correct?

A The distance between them decreases and Y overtakes X.
B The distance between them increases as X falls faster.
C The distance between them remains constant.
D The velocities of both objects are constant.

5 Which of the following will experience the **largest** inertia?

A A bowling ball that is rolling at 20 m/s.
B A leaf that is free falling with an acceleration of 10 m/s².
C A car that is travelling at 100 km/h.
D An airplane that is at rest.

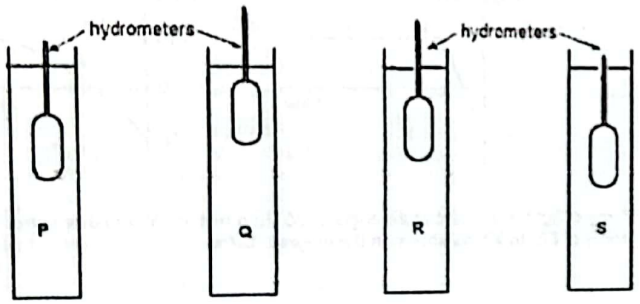
6 A block of iron is brought from Earth to the surface of the Moon with gravitational field strengths of 10 N/kg and 1.6 N/kg respectively.

statement	
1	Its mass decreases.
2	Its weight decreases.
3	Its density remains unchanged.

Which of the following statements is/are true about the iron block when it is on the Moon?

A 1 only
B 1 and 3
C 2 and 3
D 1, 2 and 3

7 Hydrometers are used to measure the density of four different liquids, P, Q, R and S as shown.

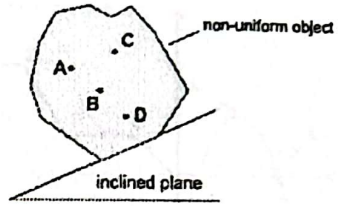


Which arrangement correctly shows the **increasing** density of the four liquids?

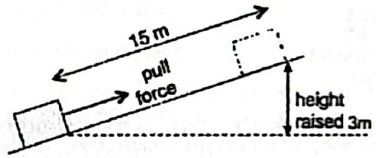
A S, P, R, Q
B S, P, Q, R
C Q, R, P, S
D Q, R, S, P

8 A non-uniform object is placed on an inclined plane. The object is just about to topple.

Which position is the centre of gravity?



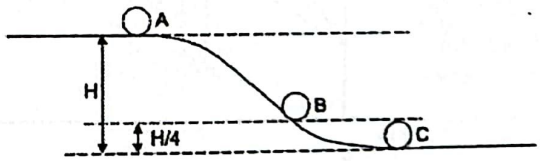
9 An object of mass 20 kg is pulled up a slope of 15 m. The object is raised by a vertical height raised of 3 m. The frictional force between the object and the slope is 30 N.



What is the minimum work done by the pulling force?

A 150 J B 450 J C 510 J D 1050 J

10 A ball, initially at rest at A, rolls down a smooth slope as shown in the figure below. Air resistance can be ignored. Assume that the gravitational potential energy of the object is zero at C.



What is the ratio $\frac{\text{gravitational potential energy}}{\text{kinetic energy}}$ at B?

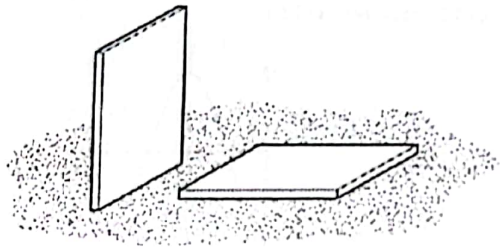
A 0.25 B 0.33 C 2.0 D 3.0

11 A small emergency generator supplies 432 MJ of electrical energy in 24 hours.

What is the average power output of the generator?

A 5000 W B 300 000 W C 18 000 000 W D 432 000 000 W

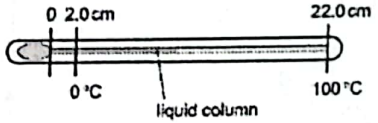
12 A builder leaves two identical, heavy, stone tiles resting on soft earth. One is vertical and the other is horizontal.



Which row correctly compares the forces and the pressures that the tiles exert on the earth?

	forces	pressures
A	different	different
B	different	same
C	same	different
D	same	same

13 The diagram shows a liquid-in-glass thermometer.



At 0 °C, the length of the liquid column is 2.0 cm. At 100 °C, the length of the liquid column is 22.0 cm.

What is the length of the liquid column at 60 °C?

A 12.0 cm B 13.2 cm C 14.0 cm D 14.4 cm

14 A gas in a sealed cylinder with fixed volume is heated.

Which of the following does not increase as the gas is heated?

A the average distance between the gas molecules
B the average kinetic energy of the gas molecules
C the average number of collisions between gas molecules
D the frequency of gas molecules hitting the cylinder walls

15 Cooling fins are used in many devices such as refrigerators and car radiators.

Below are three statements about cooling fins.

statement	
1	The cooling fins are made of metal to ensure that thermal energy is being radiated quickly to the environment.
2	The cooling fins have a large surface area for heat to be dissipated quickly to the environment through convection and radiation.
3	Cooling fins are usually painted white to increase the rate of radiation to the surroundings.

Which statement(s) about the cooling fins is/are correct?

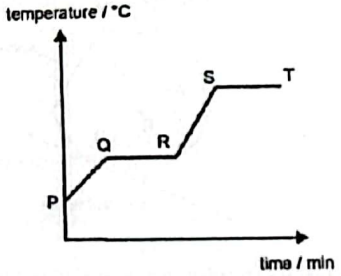
A 1 and 2
B 2 only
C 2 and 3
D 1, 2 and 3

16 Containers A and B are filled with equal amounts of hot water at the same temperature. The temperature of the water in the containers are measured with a thermometer sometime later. It is observed that container A has a much lower temperature than container B.

Which of the following is a possible reason?

A Container A is made of ceramic and container B is made of metal.
B Container A has a lid over it and container B is not covered.
C Container B is made of steel and container A is made of plastic.
D Container B has a smooth and shiny surface and container A has a rough and dull surface.

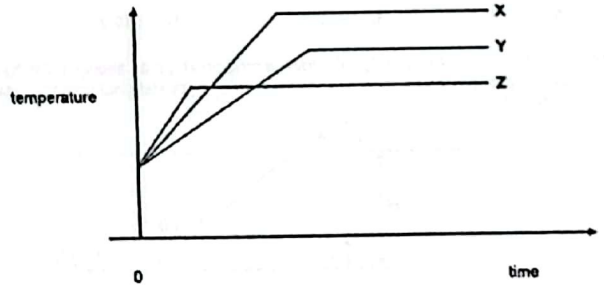
17 A solid substance is placed in a boiling tube and heated steadily. The temperature-time graph of the substance is shown below.



At which region(s) do the substance gain internal kinetic energy?

A PQ and RS
B QR and ST
C PQ, QR and RS
D All regions

18 Equal masses of three liquids X, Y and Z are heated from room temperature. Energy is supplied by heating at the same rate to each liquid. The graph shows how the temperature of each liquid varies with time after heating starts.

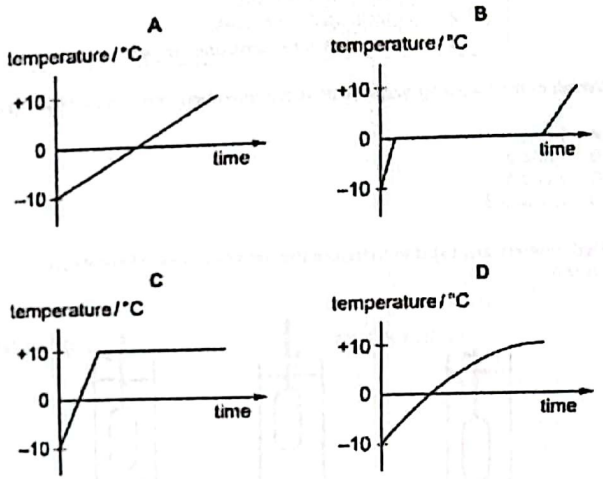


What can be deduced from the graph?

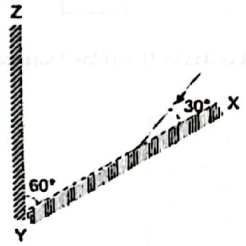
A X has the largest latent heat of vaporisation.
B Y has the smallest specific heat capacity.
C Z has the smallest latent heat of vaporisation.
D Z has the smallest specific heat capacity.

19 Ice at –10 °C is heated at a constant rate until it is water at +10 °C.

Which graph shows how the temperature changes with time?



20 A ray of light is incident at an angle of 30° to a mirror XY. Another mirror YZ is arranged at an angle of 60° to XY as shown in the diagram below.

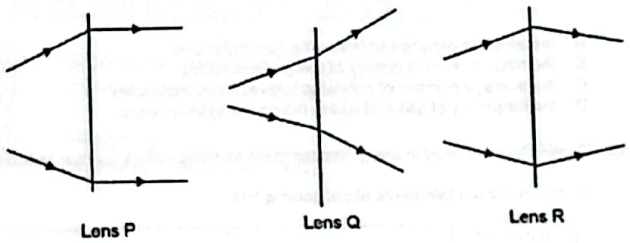


After reflection from XY, the ray is incident on YZ.

What is the angle of incidence of the ray at the mirror YZ?

A 0° B 10° C 30° D 60°

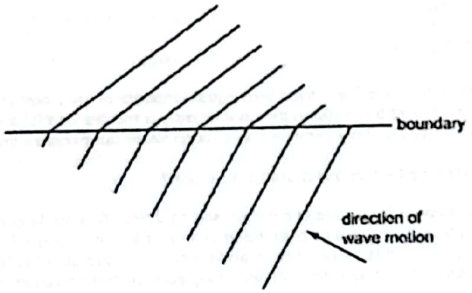
21 Rays of light pass through three lenses.



Which len(s) is/are not a converging lens?

A Lens Q only
B Lens R only
C Lens P and R
D Lens Q and R

22 The diagram shows the refraction of water waves as they cross a boundary in a ripple tank.



What causes this refraction?

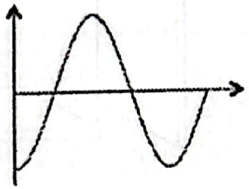
A a change in frequency due to a change in depth
B a change in frequency due to a change in wavelength
C a change in speed due to a change in depth
D a change in speed due to a change in frequency

23 Which waves consist of compressions and rarefactions?

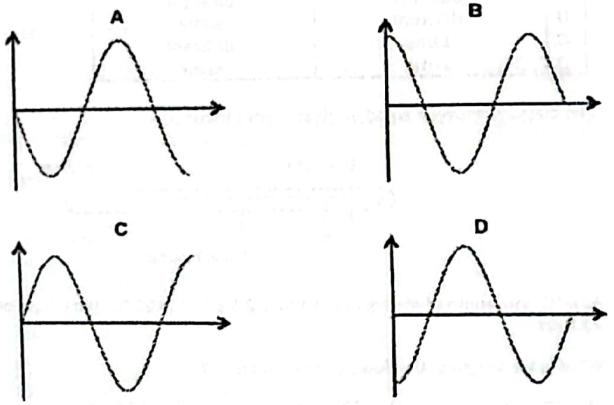
A gamma rays
B infrared waves
C water waves
D ultrasound

24 A student generates a transverse wave in a long rope, as shown in the diagram below. The waves move from left to right.

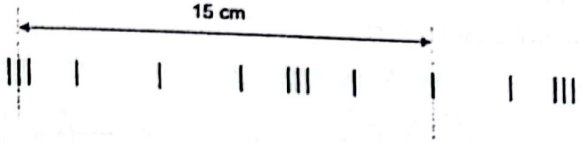
He makes 1.25 oscillations in 1.0 s.



What is the shape of the rope 2.2 s later?



25 A longitudinal wave of period 2.0 s passes along a spring. The diagram below shows the position of coils at a particular time.



Which of the following shows the wavelength of the wave above and the speed of the wave?

	wavelength / cm	speed of wave / cm s^{-1}
A	7.5	7.5
B	7.5	10
C	10	5
D	10	7.5

26 Different parts of the electromagnetic spectrum are used for different purposes.

Below are four statements about parts of the spectrum.

statement	
1	Infra-red waves are used in television remote controllers.
2	Radio waves are used to sterilize hospital equipment.
3	Ultra-violet waves are used for intruder alarms.
4	X-rays are used for security checks.

Which statements are correct?

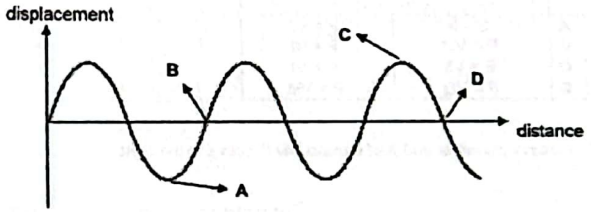
A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

27 Which of the following shows the correct arrangement of electromagnetic waves in **decreasing** order of wavelength?

A radio wave, infra-red, X-ray, microwave, gamma ray
B radio wave, microwave, infra-red, X-ray, gamma ray
C gamma ray, infra-red, X-ray, microwave, radio wave
D gamma ray, X-ray, infra-red, microwave, radio wave

28 The diagram below shows a displacement-distance graph of a longitudinal wave. Displacement to the right is taken to be positive.

Which point indicates a centre of compression?

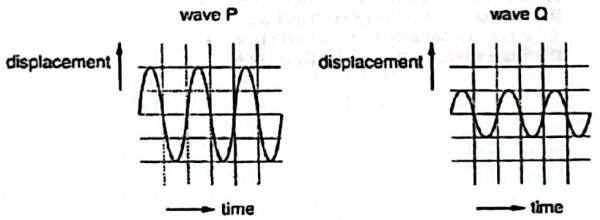


29 A flash of lightning and the corresponding thunderclap are detected 6 s apart. It is calculated that the lightning struck about 1800 m away.

On which assumption is the calculation based?

A Light reaches us almost instantaneously, but sound travels at 300 m/s.
B Light travels 300 m/s faster than sound.
C Sound reaches us almost instantaneously, but light travels at 300 m/s.
D The sound of the thunder was emitted 6 s after the flash.

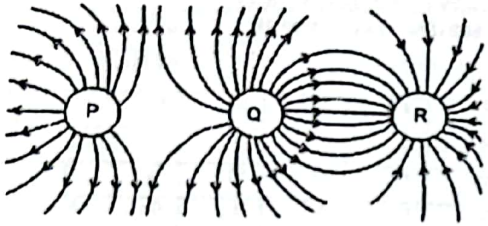
30 The diagrams represent two different sound waves.



How do the frequency and pitch of P compare with the frequency and pitch of Q?

	frequency of P	pitch of P
A	greater than Q	higher than Q
B	greater than Q	same as Q
C	same as Q	higher than Q
D	same as Q	same as Q

31 The electric field pattern between three spheres P, Q and R is shown.



Which is the correct charge on each sphere?

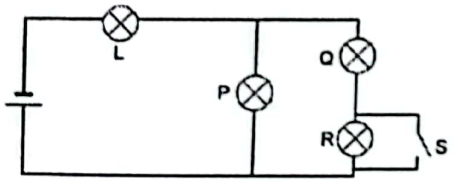
	P	Q	R
A	+	+	+
B	+	+	-
C	-	-	+
D	-	-	-

32 A charged cloud carrying a charge of 150 C passes all its charge to the earth through lightning. The lightning lasts for 0.5 ms.

What is the current of the lightning?

A 75 A B 300 A C 75 000 A D 300 000 A

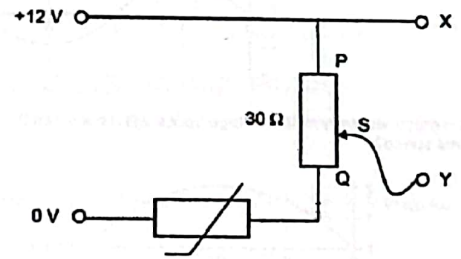
33 The diagram shows a circuit with four identical light bulbs L, P, Q and R.



Which option describes the changes in brightness of the bulbs L and P when switch S is closed?

	L	P
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

34 A variable potential divider has a sliding contact S that can be moved between end P and end Q of a 1.0 m long resistance wire of 30 Ω. The potential divider is connected in series to a constant 12 V power supply and a thermistor. The resistance of the thermistor can vary from 10 Ω to 90 Ω.



If the temperature of the thermistor is high, which of the following is a possible description of the potential difference between X and Y as S moves from P to Q?

A It decreases from 12.0 V to 9.0 V.
B It decreases from 12.0 V to 3.0 V.
C It increases from 0 V to 3.0 V.
D It increases from 0 V to 9.0 V.

35 The metal case of an electric heater is earthed. The plug to the heater contains a 5 A fuse. There is a current of 4 A when the heater works normally.

The cable to the heater becomes so worn that the live wire makes electrical contact with the case.

What happens?

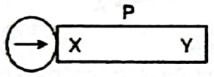
A The current flows to earth and the fuse is not affected.
B The fuse melts and switches off the circuit.
C The metal case becomes live and dangerous.
D The metal case becomes very hot.

36 Energy is represented by the letter E, current by I, power by P, charge by Q, potential difference by V and time by t.

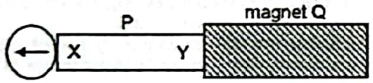
Which pair of equations is correct?

	equations	
A	E = It	P = VIt
B	E = VI/t	P = VI
C	E = VIt	P = VI
D	E = VQ	P = VI/t

37 A compass placed at end X of a metal bar P points to the right.



When Y, the opposite end of bar P is next to a magnet Q, P is attracted to Q. The compass at X points to the left.



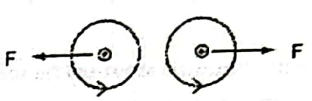
What can be deduced about P?

A It is made of a material such as aluminium.
B It is made of a material such as iron.
C It is a magnet with X as the North pole.
D It is a magnet with X as the South pole.

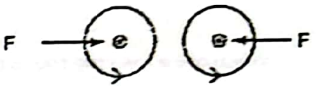
38 The diagrams show the forces F between two wires carrying currents out of the page. The magnetic fields close to the wires are also shown.

Which diagram is correct?

A



B



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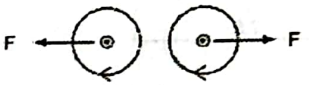

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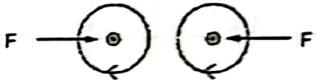
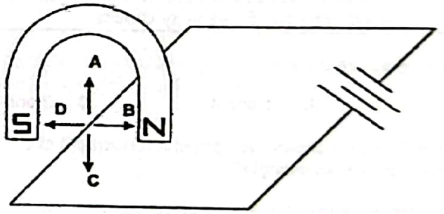
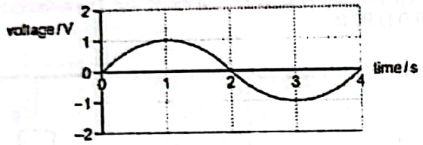


39 A current-carrying wire is placed between the poles of magnet.

Which direction will the wire move when the current flows?

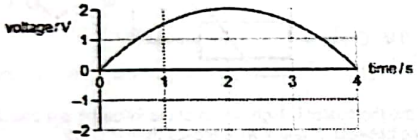


40 A simple a.c. generator produces a voltage that varies with time as shown.

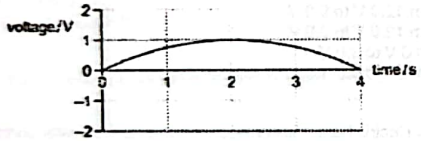


Which graph shows how the voltage varies with time when the generator rotates at twice the original speed?

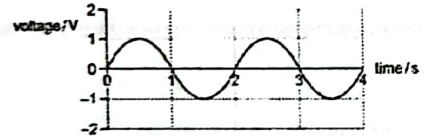
A



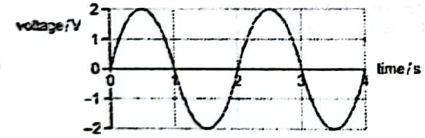
B



C



D



End of paper

DUNEARN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2023
PHYSICS 6091/02 Secondary 4E

Paper 1 MCQ

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