Name: ..... Register no: ..... Class: .....

NGEE ANN SECONDARY SCHOOL

O

PRELIMINARY EXAMINATION

PHYSICS **6091/01**

PAPER 1 **17 August 2023**

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 index number at the top of this cover page.

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 Multiple Choice Answer Sheet (OAS).

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.
Where necessary, take the gravitational field strength, g, to be 10 N/kg.

Checked by student: _____ Date: _____

This document consists of **19** printed pages and **1** blank page.

Multiple Choice Questions (40 marks)

1 What is the ratio $\frac{10^{-3}\ \text{GHz}}{10^{3}\ \text{kHz}}$?

A 10^{-9}
B 10^{-6}
C 10^{0}
D 10^{3}

2 Vectors P and Q are drawn to scale.

Which diagram represents the vector (P – Q)?

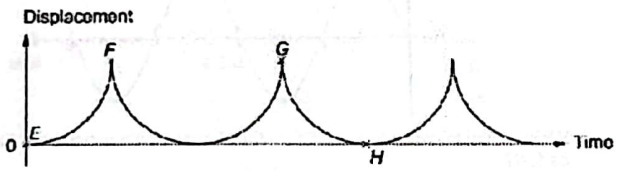
A

B

C

D

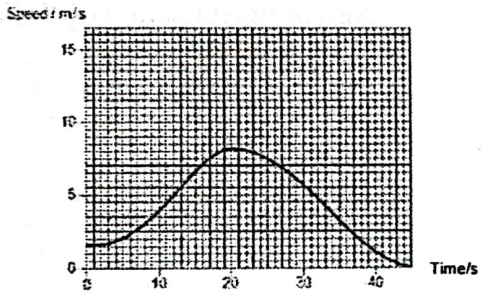
3 The following is a displacement-time graph of a small rubber ball that is released from a height of 1.0 m above a table with zero initial speed. The rubber ball bounces for several times.



Neglecting the air resistance, which point in the graph represents the second bounce?

A point E B point F C point G D point H

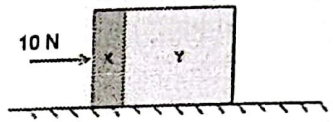
4 The graph shows the speed-time graph of a cyclist who is moving in a straight line.



What is the acceleration of the cyclist at 20 seconds?

A $-0.5\ m\ s^{-2}$
B $0\ m\ s^{-2}$
C $0.5\ m\ s^{-2}$
D $11.5\ m\ s^{-2}$

5 Two blocks, X and Y, of masses 1 kg and 4 kg respectively, are accelerated along a smooth horizontal surface by a 10 N force applied to block X as shown.



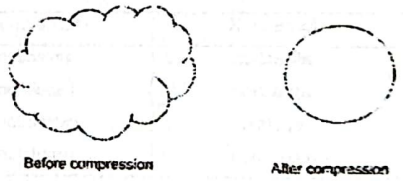
What is the magnitude of the force exerted on block Y by block X during this acceleration?

A 2.0 N
B 2.5 N
C 8.0 N
D 12.5 N

6 A force F is applied to a freely moving object. At one instant of time, the object has velocity v and acceleration a. Which quantities must be in the same direction?

A a and v only
B a and F only
C v and F only
D a, v and F

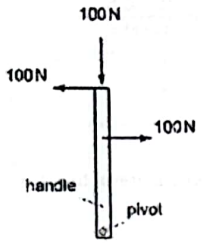
7 The diagram shows a ball of bread dough, before and after it has been compressed. Air is knocked out of the dough during compression.



What happens to the weight and the density of the dough when it is compressed?

	weight	density
A	stays the same	stays the same
B	stays the same	increase
C	decreases	increases
D	increases	decreases

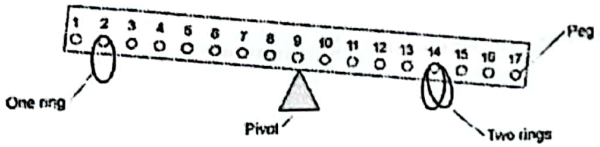
8 The diagram shows a handle with three forces, each 100 N, applied to it. The handle is free to move.



What is the effect of the forces on the handle?

A The handle will not move.
B The handle will move downwards.
C The handle will turn anticlockwise.
D The handle will move clockwise.

9 The diagram shows a child's balancing game.



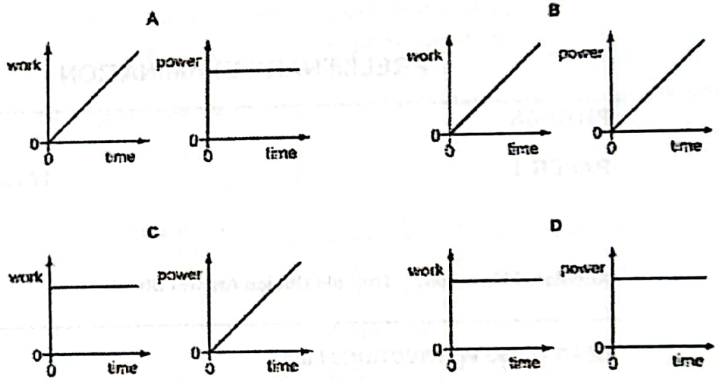
The wooden rod is uniform and all the rings are of equal mass. Two rings are hung on peg 14 and one on peg 2. The rod is pivoted at peg 9.

On which hook must a fourth ring be hung in order to balance the rod?

A 2
B 3
C 5
D 6

10 A car moves along a level road at constant speed. Work is done by the engine and power is developed by the engine.

Which pair of graphs shows how the work done and the power developed vary with time?



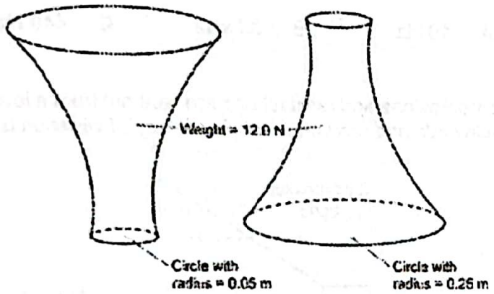
11 A stone of mass m is held at rest in water. The stone is released and falls vertically a distance h. The stone reaches a speed v.
Some of the original energy of the stone is transferred to the water. As it falls, resistive forces cause the temperature of the water and stone to increase.

Which expression represents the gain in thermal energy of the water and the stone?

A $\frac{1}{2}mv^2$
B $mgh - \frac{1}{2}mv^2$
C mgh
D $mgh + \frac{1}{2}mv^2$

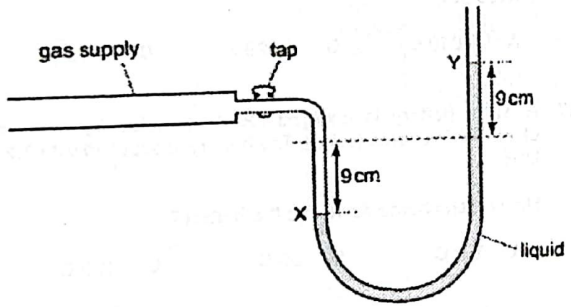
12 The ornament in the diagram is designed to balance in either of the positions shown.

What is the difference in the pressure on the ground when the ornament's position is changed?



A 1000 Pa B 1200 Pa C 1500 Pa D 2000 Pa

13 The diagram shows the levels X and Y in a liquid manometer with the gas tap open.



What is the pressure of the gas supply?

A 18 cm of liquid below atmospheric pressure
B 9 cm of liquid below atmospheric pressure
C 9 cm of liquid above atmospheric pressure
D 18 cm of liquid above atmospheric pressure

14 A syringe is half-filled with air and sealed. The plunger is then pulled outwards, causing the volume of the air to increase. This is done slowly, so that the expansion happens at a constant temperature.

What happens to the pressure of the air, and to the speed of the air molecules?

	pressure inside the syringe	speed of air molecules
A	stays the same	stays the same
B	increases	decreases
C	decreases	stays the same
D	decreases	decreases

15 The molecules of a substance become more closely packed and move more quickly.

What is happening to the substance?

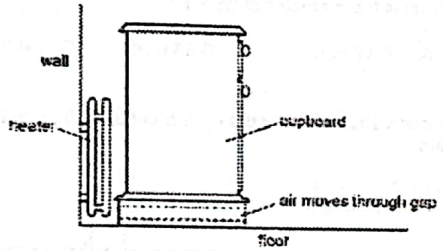
A A gas is being heated and compressed.
B A gas is being heated and is expanding.
C A liquid is boiling.
D A liquid is evaporating at room temperature.

16 The length of mercury in the bore of a thermometer is 5.0 cm at 0 °C and 11.0 cm at 60 °C.

What is the length in the bore when the temperature is −10 °C?

A 1.0 cm
B 4.0 cm
C 6.0 cm
D 10.0 cm

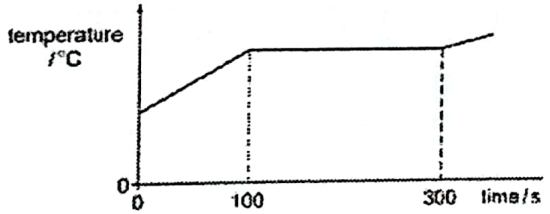
17 A cupboard is placed in front of a heater. Air can move through a gap under the cupboard.



Which of the following is true about the temperature of the air under the cupboard and its direction of motion?

	air temperature	air direction
A	cool	away from the heater
B	cool	towards the heater
C	warm	away from the heater
D	warm	towards the heater

18 A mass of 0.20 kg of a substance is initially solid.
It is heated at a steady rate of 500 W.
The graph shows how the temperature of the substance changes with time.



What is the specific latent heat of fusion of the substance?

A 20 kJ/kg B 30 kJ/kg C 500 kJ/kg D 750 kJ/kg

19 Several ice cubes at a temperature of 0 °C are dropped into a beaker of water and they begin to melt immediately.

What happens to the temperature of the water and what happens to the temperature of the ice cubes while they are melting?

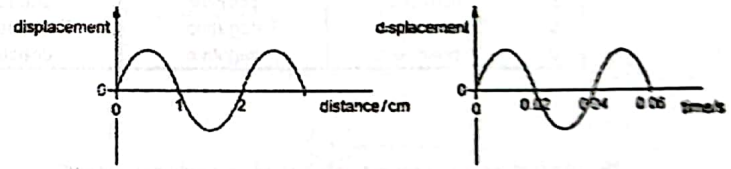
	temperature of the ice cubes	temperature of the water
A	increases	decreases
B	stays constant	decreases
C	increases	stays constant
D	stays constant	stays constant

20 A water wave in a ripple tank refracts as it passes from deep water to shallow water.

Which properties change as the wave refracts?

A frequency and amplitude
B frequency and wavelength
C speed and frequency
D speed and wavelength

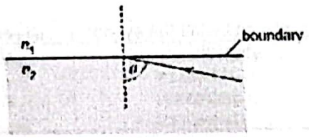
21 The displacement-distance and displacement-time graphs below are for a water wave in a ripple tank.



What is the speed of the water wave?

A 0.02 cms^{-1} B 0.02 cms^{-1} C 25 cms^{-1} D 50 cms^{-1}

22 A ray of monochromatic light is incident at the boundary between two transparent materials of refractive index n_1 and n_2. The critical angle θ is equal to 80°.



What is the ratio $\frac{n_1}{n_2}$

A 0.17 B 0.98 C 1.02 D 5.76

23 An object is placed 15.0 cm in front of a converging lens of focal length 10.0 cm. Which of the following is the characteristic of the image produced by the lens?

A laterally inverted and magnified
B real and magnified
C real and diminished
D virtual and upright

24 Visible, red light has a wavelength of around 70 x 10 μm.
Two other types of electromagnetic radiation, X and Y, have different wavelengths to the visible, red light.

Wavelength of X = 400×10^{-7} m
Wavelength of Y = 3.0×10^{-2} m

Which types of radiation could X and Y be?

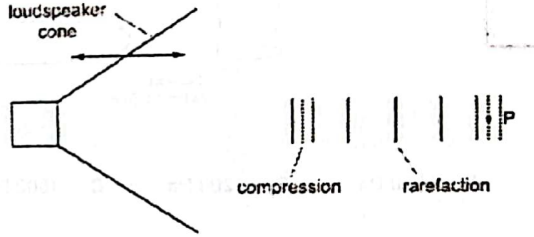
	X	Y
A	visible blue light	microwaves
B	X-rays	ultraviolet
C	infrared	radiowaves
D	microwaves	ultraviolet

25 A teacher uses a piece of lab equipment called a signal generator, v connects to a speaker. This apparatus can be used to make a particular noise. The teacher makes four sounds of different frequencies with generator.

Which one can be heard by the student?

A 10 Hz B 30 kHz C 440 Hz D 120 kHz

26 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forwards. The frequency of vibration is 50 Hz.



A compression is at point P. How much time elapses before the next rarefaction arrives at P?

A 0.010 s B 0.020 s C 25 s D 50 s

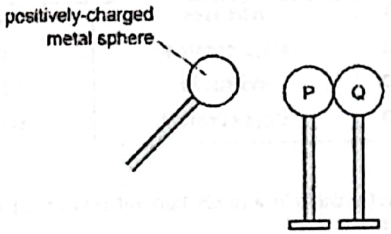
27 A 12 V battery is charged for 20 minutes by connecting it to a source of electromotive force (e.m.f). The battery is supplied with 7.2×10^4 J of energy in this time.

How much charge flows into the battery?

A 5.0 C B 60 C C 100 C D 6000 C

28 Two metal spheres P and Q are mounted on insulating stands and are touching each other. They are uncharged.

A positively-charged metal sphere on an insulating handle is brought close to P but does not touch it. This induces charges on P and Q.



The positively-charged metal sphere is held in this position and sphere Q is moved to the right, away from sphere P.

What are the signs of the induced charges on P and Q and how do the sizes of these charges compare?

	charge on P	Charge on Q	size of the charges
A	negative	positive	equal
B	negative	positive	unequal
C	positive	negative	equal
D	positive	negative	unequal

29 Which of these is a correct definition of conventional current?

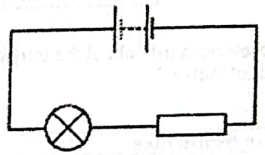
A Current that flows from lower potential to higher potential.
B The current which remains static.
C Current constituted by the flow of ions.
D Current that flows from higher potential to lower potential.

30 Two wires have the same length and the same resistance. Wire X is made of a metal of resistivity 1.7×10^{-4} Ωm, and wire Y is made of a metal of resistivity 5.6×10^{-4} Ωm. The diameter of wire X is 0.315 mm.

What is the diameter of wire Y?

A 0.17 mm B 0.33 mm C 0.57 mm D 1.0 mm

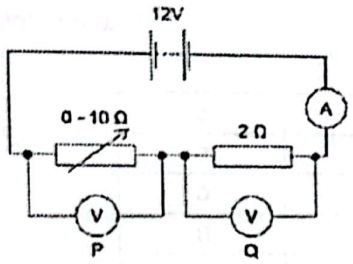
31 A book shop owner sets up the circuit below, but he noticed that the lamp is too dim.



What change can be made to the circuit to increase the brightness of the lamp?

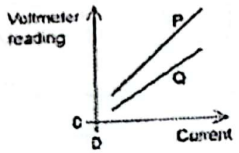
A Putting another resistor in parallel with the battery.
B Putting a resistor in parallel with the lamp.
C Putting another resistor in series with the resistor.
D Putting another resistor in parallel with the resistor.

32 A 12 V battery is in series with an ammeter, a 2 Ω fixed resistor and a 0 – 10 Ω variable resistor. High-resistance voltmeters **P** and **Q** are connected across the variable resistor and the fixed resistor, respectively, as shown.

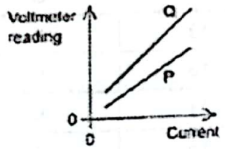


Which graph shows the variation with current of the voltmeter readings?

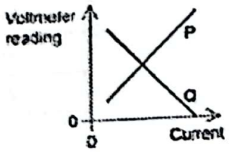
A



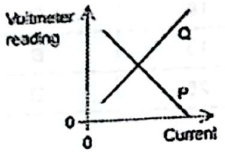
B



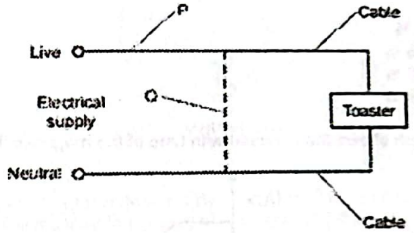
C



D



33 Both fuses and circuit breakers are devices which protect devices from high currents that could cause them to get too hot and catch fire. The diagram shows two possible positions where a fuse or a circuit breaker could be positioned.



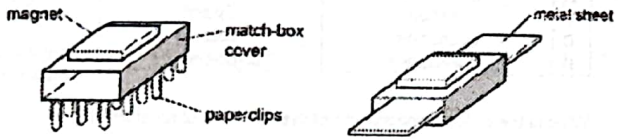
Which location would be suitable for a fuse, and which would be suitable for a circuit breaker?

	fuse	circuit breaker
A	P	P
B	P	Q
C	Q	P
D	Q	Q

34 Which costs the **most** if operated from the same mains supply?

A a 5000 W electric cooker used for 1 minute
B a 1000 W electric fire used for 10 minutes
C a 500 W electric iron used for 1 hour
D a 100 W lamp used for 1 day

35 Two different sheets of metal (X and Y) are placed inside a match-box cover, between a magnet and paperclips, one after another as shown in the diagram below.



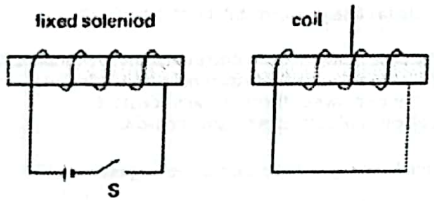
When sheet X is placed inside the match-box cover, the paperclips remain attached while when sheet Y is placed inside the match-box cover, all the paperclips fall off.

What are sheet X and sheet Y made of?

	sheet X	sheet Y
A	iron	steel
B	brass	iron
C	aluminuim	copper
D	nickel	aluminium

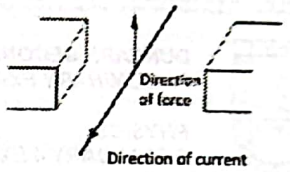
36 The figure below shows a fixed solenoid near a coil hung free to move. The material within the coil and solenoid is a paper roll.

What happens to the coil when switch S is closed?



A It is attracted to the solenoid and then returns to rest.
B It is repelled by the solenoid and then returns to rest.
C It remains at rest.
D It swings back and forth.

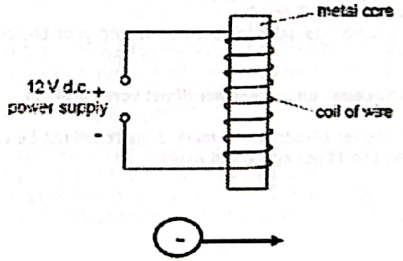
37 A current-carrying wire is placed between two magnetic poles as shown in the diagram below. It experiences an upwards force.



What is the orientation of the magnetic poles?

	Left magnet	Right magnet
A	N	N
B	S	N
C	N	S
D	S	S

38 The diagram shows a 12 V d.c. power supply connected across a coil with a metal core. An electron traveling to the right approaches the bottom of the metal core.



What is the direction of the force acting on the electron as it approaches the bottom of the coil?

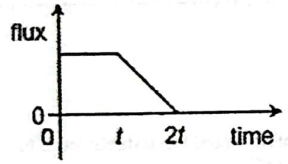
A downwards
B upwards
C into the paper
D out of the paper

39 A transformer has 500 turns on the primary coil and 1500 turns on the secondary coil. The primary coil draws a current of 0.5 A from a 230 V ac supply. The current in the secondary coil is 0.15 A.

What is the efficiency of the transformer?

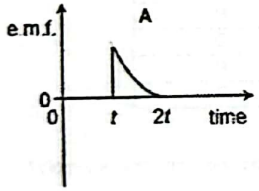
A 2 %
B 45 %
C 90 %
D 99 %

40 The graph shows the variation with time of the magnetic flux linking a coil.

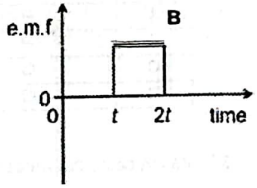


Which graph shows the variation with time of the e.m.f induced in the coil?

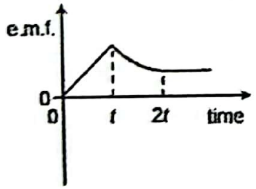
A



B



C



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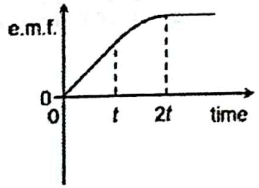

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NGEE ANN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2023
SECONDARY 4 EXPRESS
PHYSICS 6091
PAPER 1

MARK SCHEME

1	C
2	C
3	C
4	B
5	C
6	B
7	C
8	C
9	D
10	A
11	B
12	C
13	D
14	C
15	A
16	B
17	B
18	C
19	B
20	D

21	D
22	B
23	B
24	A
25	C
26	A
27	D
28	A
29	D
30	C
31	D
32	D
33	A
34	D
35	D
36	D
37	C
38	D
39	C
40	B