

ST JOSEPH'S INSTITUTION PRELIMINARY EXAMINATION 2022 (YEAR 4)

CANDIDATE NAME		
CLASS	INDEX NUMBER	

PHYSICS

6091/1 13 September 2022

Paper 1 Multiple Choice

3 September 2022

Additional Materials: Multiple Choice Answer Sheet

1 hour (10:00 – 11:00)

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 in the multiple choice answer sheet.

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.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done on this question paper.

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

- 1 What are the SI base units of pressure?
 - N/m² Α
 - kg/m² В
 - kgm/s² С
 - kg/ms² D
- 2 The figure below shows the velocity-time graphs of two cars travelling side by side on a straight level road. The cars start their journey from the same starting line.



Which of the following statement(s) is/are correct?

- 1 Car B passes car A at $t = t_P$.
- 2 Both cars have equal velocity at $t = t_P$.
- 3 Car B has a higher acceleration than car A at t = 0.
- 1 and 3 only Α

В 1, 2 and 3

С 2 and 3 only

- 2 only
- D

3 A steel ball is dropped from a height onto a hard floor. Taking the downward direction to be positive, the following displacement time graph describes the motion of the bouncing ball.



Which of the points, A, B, C or D indicates the second time that the ball hits the floor?

- A point A
- **c** point C

- **B** point B
- D point D
- 4 A child with a mass of 25 kg is hanging from the ceiling of an elevator by a rope.



The elevator is travelling upwards at a constant deceleration of 1.0 m/s^2 . What is the force exerted by the rope on the child?

Α	0 N	В	225 N
С	250 N	D	275 N

5 Which diagram shows the magnitude and direction of the resultant *R* of the two forces F_1 and F_2 ?



6 A momentary force is applied to a hockey puck on a frictionless skating rink.

Assuming air resistance is negligible, which of the following statements best describes the subsequent motion of the hockey puck?

- A It accelerates uniformly.
- **B** It decelerates to rest uniformly.
- **C** It moves with uniform velocity.
- **D** It stops abruptly.

7 The diagram shows a pail containing water and sand.



More sand is added to the pail. This affects the position of the centre of gravity of the pail and its contents, and the stability of the pail.

Which of the following shows how the position of the centre of gravity and the stability of the pail will be affected?

	centre of gravity	stability
Α	moves from X towards Y	decreases
В	moves from X towards Y	increases
С	moves from Y towards Z	decreases
D	moves from Y towards Z	increases

8 An object is released from rest from a height *h*. The velocity of the object after falling a distance, h/2 is v_1 . The velocity of the object after falling a distance, *h* is v_2 .

If air resistance is negligible, what is the ratio of v_2 to v_1 ?

- **A** 0.50 **B** 0.71 **C** 1.4 **D** 2.0
- **9** A beaker floats in a container of liquid as shown.



The cross-sectional area of the beaker is 0.012 m^2 . The weight of the beaker is 32 N. What is the density of the liquid?

A 670 kg/m³

C 6700 kg/m³

- **B** 890 kg/m³
- **D** 8900 kg/m³

10 The lengths of the alcohol thread in a thermometer are 5.0 cm and 25.0 cm when the temperatures are 10 °C and 78 °C respectively. When the thermometer bulb is placed in a liquid, the length of the alcohol thread is 3.0 cm.

What is the temperature of the liquid?

Α	3.2 °C	В	6.0 °C
С	6.8 °C	D	10.2 °C

11 What surrounds the bulb of a thermometer during the marking the upper and lower fixed points?

	upper fixed point 100 °C	lower fixed point 0 °C
Α	boiling water	pure ice
В	boiling water	pure melting ice
С	steam	pure ice
D	steam	pure melting ice

12 Which graph shows the relationship between the pressure and the volume of a fixed mass of gas at constant temperature?



13 The diagram shows a glass tube filled with water and suspended above a bench. The water is free to circulate around the tube.

At point P, there is a convection current moving in a downwards direction. At which point is the tube heated to cause this convection current?



14 The fins of a car radiator system, as shown in the diagram, is very efficient in removing the heat generated from its engine.



Which of the following statements best explains this?

- **A** A high temperature difference between the radiator and surroundings allows a high rate of heat loss by conduction.
- **B** The design of the radiator allows heat to be transferred to the surroundings rapidly by convection.
- **C** The radiator fins increases surface area allowing a high rate of heat transfer.
- **D** The radiator is made of metal, which is a good thermal conductor.

15 A 0.50 kg ball is released from rest from the top of a rough 200 m slope at X, as shown in the diagram. It comes to a stop at Y.
Assuming all the work done against friction is converted to the increase in the thermal

Assuming all the work done against friction is converted to the increase in the thermal energy of the ball, what will be the rise in the temperature of the ball?



The gravitational field strength g is 10N/kg and the specific heat capacity of the ball is 400 J/kg°C.

Α	0.50 °C	В	0.75 °C
С	1.5 °C	D	3.0 °C

16 The diagram below shows how the temperature of a substance, initially in gaseous state, varied with time.



Which of the following correctly describes what happened to the internal kinetic energy and to the internal potential energy of the molecules of the substance during processes X and Y?

	internal kinetic energy		internal pote	ential energy
	Х	Y	Х	Y
Α	constant	decrease	decrease	constant
В	constant	decrease	increase	constant
С	decrease	constant	increase	constant
D	decrease	decrease	increase	constant

17 The diagram shows a water wave travelling at a speed of 20 cm/s to the right. At time = 0, particle X is at the crest of the wave. Particle Y is 30 cm to the right of particle X.



Which of the following shows a possible displacement-time graph of particle Y?







18 A pendulum bob oscillates above a water surface, creating a water wave moving towards a hard surface AB.

Which of the following shows the reflection of the water wave by the hard surface AB?



19 An art installation room consists of a mirror and a wall completely covered by a 3.0 m long painting. If a person stands at the centre of the rectangular room facing the mirror, he will be able to see the full length of the painting that was drawn on wall, behind him.



3.0 m long painted wall (diagram is not drawn to scale)

What is the shortest possible length of the mirror for the person to just be able to see the full length of the painting?

- **A** 1.0 m **B** 1.2 m **C** 1.5 m **D** 2.0 m
- **20** A ray of red light in air enters into a semi-circular glass block.

Which diagram shows the correct partial reflection and the refraction of the ray?









D





21 A parallel beam of light is incident on a thin diverging lens. The focal length of the lens is FL, as shown in the diagram.



Which ray diagram shows how the beam bends after it has passed through the lens?







С

D



22 Which row lists the applications of parts of the electromagnetic spectrum?

	gamma ray	infra-red radiation	microwave
Α	intruder alarm	satellite communication	sunbed
В	satellite communication	treatment of cancer	remote controller
С	treatment of cancer	intruder alarm	remote controller
D	treatment of cancer	remote controller	satellite communication

23 The diagram shows the electromagnetic waves arranged in the correct order.

radio waves	R	S	т	Q	X-rays	gamma rays
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Which row lists the correct electromagnetic waves?

	S	Т
Α	infra-red radiation	visible light
В	infra-red radiation	ultra-violet radiation
С	microwaves	infra-red radiation
D	visible light	ultra-violet radiation

24 Statements 1, 2 and 3 are about the speeds and the frequencies of ultra-violet radiation, audible sound and ultrasonic sound.

statement	
1	The frequencies of audible sound and ultrasonic sound are the
	same, and is lower than the frequency of ultra-violet radiation.
2	The speeds of audible sound and ultrasonic sound are the same,
	and are lower than the speed of ultra-violet radiation.
3	The speeds of the three waves increase as they travel from gas into
	a solid.

Which statements are correct?

- A statement 1 and 2
- **B** statement 2 and 3
- **C** statement 2 only
- **D** statement 3 only

25 An ultrasonic sound transmitter and a receiver are installed at the ceiling of a carpark as shown in the diagram. They can be used to determine the height of a car. Diagram 1 shows the c.r.o. display when the lot is empty. Diagram 2 shows the c.r.o. display when the transmitter and receiver.





The time-base of the c.r.o. is 2.5 ms/div. If the speed of ultrasound is 330 m/s, what is the height of the car?

A 1.44 m B 1.86 m C	2.88 m D 3.30 m
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26 A sound wave is transmitted in water. The shortest time duration for the water particles to move from its rest position to its maximum displacement is 2.5 ms. The distance from the centre of a compression to the adjacent centre of rarefaction is 7.5 m.

What is the distance travelled by the sound wave in 0.10 s?

A 750 m B 1500 m C 3000 m	D	6000 m
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27 The diagram shows some white plastic beads of negligible mass in a clear plastic box.



The box is shaken, causing the beads to rub against the box. The beads are then found to stick to the inner surface of the box.



Which of the following statements is incorrect?

- A All the charged beads have like charges.
- **B** Fewer beads will stick to the inner surface of the box if the experiment is done in humid conditions.
- **C** The box loses electrons and the beads gain electrons.
- **D** The box and the beads both have like charges due to friction between them.

28 The diagram shows an uncharged sphere S coated with metallic paint. The ball is suspended from an insulating thread. It is placed in the middle of two equally and oppositely charged objects as shown.



S is then earthed with the two charged objects still in position. Which diagram shows the resulting charge distribution on S?



29 A metal electrical conductor has a resistance of 5.6 k Ω . A potential difference of 9.0 V is applied across its ends.

How many electrons pass a point in the conductor in one minute given that the magnitude of the charge of an electron is 1.6×10^{-19} C?

Α	1.0 × 10 ¹⁶	В	6.0×10^{17}
С	6.0×10^{20}	D	2.3×10^{23}

30 A 12 V battery is connected in series to an ammeter, a 6.0 Ω resistor, and a voltmeter as shown in the diagram.



What are the readings on the ammeter and on the voltmeter?

	ammeter reading / A	voltmeter reading / V
Α	2.0	0
В	2.0	12
С	0.0	12
D	0.0	0

31 A power supply of electromotive force *E* and negligible internal resistance is connected in the circuit shown. There is a current of 3.0 A in the 4.0 Ω resistor.



What is the value of *E*?

Α	15 V	В	29 V
С	39 V	D	51 V

32 Three identical lamps and three ammeters are connected as shown. The readings on the ammeters are I_1 , I_2 and I_3 .



Which of the following describes the changes in the ammeter readings when L_3 blows?

	I_1	<i>I</i> 2	I3
Α	decrease	decrease	decrease
В	decrease	unchanged	decrease
С	increase	increase	decrease
D	unchanged	increase	increase

33 Two resistors X and Y are connected in series with a 12 V supply. The output voltage across Y is 4.0 V.



What is the output voltage when the resistance of Y is halved?

Α	2.0 V	В	2.4 V
С	3.0 V	D	6.0 V

34 In the circuits below the cells have the same emf and the resistors are identical.



circuit X

What is the ratio of the power dissipated in circuit X to the power dissipated in circuit Y?

Α	1:2	В	2:1
С	1:4	D	4:1

35 The diagram shows the circuit for a hairdryer.



The fan motor has a power rating of 200 W and the heaters each has a rating of 500 W. The cost of electricity is 27 cents per kWh.

What is the cost of using the hairdryer for 30 minutes with switches P and Q closed and switch R opened?

Α	2.7 cents	В	6.75 cents
С	9.45 cents	D	13.5 cents

36 The cable to an electric fan becomes so worn that the live wire makes electrical contact with the metal case which is earthed. The plug to the fan contains a 5 A fuse. There is a current of 4 A when the fan works normally.

Which of the following would happen?

- A The current causes the metal case to overheat.
- **B** The current will flow to earth and the fan continues working normally.
- **C** The fuse will melt and open the circuit.
- **D** The metal case will become live and the fan continues working normally.
- **37** The diagram shows a magnet resting on an electronic balance. A wire is kept in the position as shown in the diagram.



If current flows through the wire (out of the paper) as shown in the diagram, how will it affect the reading of the electronic balance?

- A decreases
- B increases
- **C** increase and then decreases
- **D** no effect

38 The diagram shows an x-ray beam and an electron beam entering a magnetic field that is directed into the plane of the paper.



Which of the following shows the paths of the x-ray beam and the electron beam in the magnetic field?



39 The diagram shows a metal bar swinging like a pendulum to-and-fro across a uniform magnetic field. The motion induces an emf in the bar.



Which graph could represent this emf during one complete to-and-fro oscillation of the bar, starting at position O?



40 A strong bar magnet is close to a coil that is connected to an ammeter.



The magnet and the coil are moved in the following ways.

- 1 Both the magnet and the coil move to the right with the same speed.
- 2 The magnet is stationary and the coil moves to the left.
- 3 The coil is stationary and the magnet moves to the left.

In which of the following will the ammeter indicate a current?

- A 1 only
- C 1 and 2 only

- **B** 2 only
- **D** 2 and 3 only

~ END OF PAPER ~