

ST JOSEPH'S INSTITUTION PRELIMINARY EXAMINATION 2018 (YEAR 4)

CANDIDATE NAME			
CLASS		INDEX NUMBER	
PHYSICS			6091/01
Paper 1			28 August 2018
Additional Mate	erials: Multiple Choice Answer Sheet		1 hour (08:00 – 09:00)

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 spaces provided.

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 booklet.

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

Fig 1.1 shows a micrometer screw gauge when it is fully closed. Fig. 1.2 shows the 1 micrometer screw gauge when measuring the thickness of a metal sheet.



Fig 1.1

Fig 1.2

What is the correct reading for the thickness of the metal sheet?

- Α 5.45 mm **B** 5.50 mm **C** 5.55 mm **D** 5.95 mm
- 2 One oscillation of a swinging pendulum occurs when the bob moves from X to Z and back to X again. Y is the middle point of the oscillation. The first time the pendulum passes through Y, a stopwatch is started.



How many times would the pendulum pass through Y to go through 20 oscillations?



3 An object is thrown vertically upward. If air resistance is negligible, what is the acceleration and the velocity of the object when it is at the highest point?

	acceleration	velocity
Α	10 m/s² ₩	Max 🗸
В	10 m/s² ↑	Max 🗸
С	10 m/s² ↓	0 m/s
D	0 m/s² ♥	0 m/s

4 An object is released from rest from a height above the ground. If air resistance acts on the object, which graph correctly shows the motion of the object?



- **5** A crane lifts a 20 kg object from rest. The object moves upward at a constant acceleration of 4.0 m/s². What is the tension of the crane acting on the object?
 - **A** 80 N **B** 120 N **C** 200N **D** 280 N
- 6 The figure below shows a uniform plank of negligible mass of length L, pivoted at P. Two downward forces, *F* and 30 N act on the two ends such that the plank is horizontal.



What is the magnitude of the force acting on the plank at the pivot?

Α	24 N	В	60 N	С	120 N	D	150 N
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7 A book of weight, W slides along a smooth table-top until it falls off from the edge of the table at time, T. The figure below shows the path of the book.



Which graph shows how the resultant force acting on the book changes with time? Neglect air resistance.



8 A beaker is filled with 45.0 cm³ of liquid of density 0.800 g/cm³. The total weight of the beaker and the liquid is 1.04 N.

What is the mass of the beaker without the liquid?

Α	36.0 g	В	46.8 g	C 68.0 g	D 104 g
	0		<u> </u>	0	

9 A rigid L-shaped iron bar is pivoted at point P. Three forces act on the lever arm as shown in the diagram.



Assuming that the iron bar itself is weightless, what is the magnitude of the resultant moment of these forces about point P?

- **A** 2.0 Nm **B** 14 Nm **C** 18 Nm **D** 38 Nm
- **10** A square metal plate lamina of uniform mass have two holes drilled onto it as shown in the diagram.



In which region is the centre of gravity of the square metal plate lamina most likely to be?

11 A 20 kg wooden cuboid of dimension 5.0 cm x 10.0 cm x 20.0 cm rests on a table. What is the possible maximum pressure the cuboid is able to act on the table?

Α	1.0 kPa	В	4.0 kPa	С	10 kPa	D	40 kPa

12 The figure below shows a gas tap connected to 2 manometers. One of the manometers is filled with liquid X while the other is filled with water.



Which statement best explains why the difference in the levels of liquid X and the difference in the levels of water are not equal?

- A The gas tap is nearer to the manometer filled with water.
- **B** The density of liquid X is smaller than the density of water.
- **C** The gas pressure acting on water is larger than the gas pressure acting on liquid X.
- **D** The tube of the manometer filled with water is thicker than the tube of the manometer filled with liquid X.
- **13** A 5 cm long mercury thread is used to enclose methane gas in a test tube. Which orientation of the test tube will result in maximum pressure of the enclosed methane gas?



- 14 A 1000 kg space shuttle moves vertically upwards into space at a constant speed of 50 m/s. If the air resistance acting on the space shuttle is 1200 N, what is the power of the space shuttle engine?
 - **A** 60 kW **B** 440 kW **C** 500 kW **D** 560 kW
- 15 Object A is connected to object B by a taut string as shown in the figure below. A force is applied to object A to keep both objects at rest. When the force is released, object B moves vertically downwards while object A slides along the surface of the ramp.



If the surface of the ramp is rough, which statement is correct?

- A loss in GPE of object B = gain in KE of object A
- **B** loss in GPE of the whole system = gain in KE of the whole system
- **C** gain in GPE of object A + gain in KE of object A = work done by object A against friction
- **D** loss in GPE of the whole system = gain in KE of the whole system + work done by object A against friction
- **16** Heat sinks are installed in electrical appliances to absorb and dissipate heat quickly. Which of the following characteristics are suitable for a good heat sink?
 - A It has a low heat capacity and small surface area
 - **B** It has a low heat capacity and large surface area
 - **C** It has a high heat capacity and small surface area
 - **D** It has a high heat capacity and large surface area
- **17** Sphere A has a higher temperature than sphere B. Which of the following methods does not help to increase the rate of heat transfer via radiation from A to B?
 - **A** Coat sphere B with black paint.
 - **B** Connect both spheres with a shiny metal rod.
 - **C** Roughen the surface of sphere A.
 - **D** Decrease the temperature of sphere B with an ice pack.

18 When a foot is placed in water of a certain temperature, it feels colder than it does when it is in air at the same temperature.



What is the reason for this?

- **A** Air is a better conductor of heat than water.
- **B** Water is a better conductor of heat than air.
- **C** Convection current is formed in water and cool the foot further.
- **D** The foot absorb infrared radiation in air.
- **19** A small balloon is tied to a brick and is submerged into a container containing hot water. The water is allowed to cool. During the cooling process, the change in the density of the water is negligible.

What will happen to the average velocity and the frequency of the air particles in the balloon colliding with the wall of the balloon?

	average velocity	frequency of collision
Α	decreases	decreases
В	decreases	increase
С	decreases	constant
D	increases	constant

20 The graph below shows the heating curve of an unknown liquid.



What happens to the internal potential energy (IPE) and the internal kinetic energy (IKE) of the unknown liquid between AB and BC?

	between A and B	between B and C
Α	IKE increases, IPE increases	IKE increases, IPE increases
В	IKE increases, IPE constant	IKE constant, IPE increases
С	IKE increases, IPE constant	IKE increases, IPE constant
D	IKE constant, IPE increases	IKE increases, IPE constant

- **A** The heat capacity of X is half that of metal Y.
- **B** The heat capacity of X is twice that of metal Y.
- **C** The specific heat capacity of X is half that of metal Y.
- **D** The specific heat capacity of X is twice that of metal Y.
- 22 John carried out an experiment to estimate the temperature of a car engine. He placed a 50 g copper cube on top of the car engine before transferring the copper cube to a beaker containing 500 g of water at 25.0 °C. The temperature of the water increased to a maximum value of 27.0 °C.

[Beaker has negligible heat capacity, specific heat capacity of water = $4200 \text{ J/(kg}^{\circ}\text{C})$ and heat capacity of the copper cube = $19.3 \text{ J/}^{\circ}\text{C}$)]

What is the temperature of the engine?

A 191 °C **B** 245 °C **C** 4350 °C **D** 4380 °C

23 A thermocouple indicates 0.10 mV when it is used to measure the temperature of pure melting ice and 2.6 mV when it is used to measure the temperature of a hot iron rod at 500 °C. When used to measure the temperature of an unknown liquid X, it indicates 3.0 mV.

What is the temperature of the unknown liquid, X?

Α	80 °C	В	560 ⁰C
С	580 °C	D	600 °C

24 A capillary tube containing a thread of mercury is used as a thermometer to measure temperature. The length of trapped air increases when the tube is heated.



Which of the following is not a correct assumption when using the capillary tube as a thermometer?

- A External air pressure is not constant.
- **B** The cross-sectional area of the capillary tube is constant.
- **C** There is no friction between the mercury and the inner surface of the tube.
- **D** The volume of trapped air expands linearly with temperature.

25 A painter stands at the exact centre of a rectangular room facing a mirror.





If the width of the mirror is 1 m, what is the length of the painted wall that the painter sees as he looks into the mirror?

- **A** 1 m **B** 2 m **C** 3 m **D** 5 m
- 26 The figure shows a light ray passing through a converging lens and a diverging lens. Which of the following shows the correct path of the light ray as it emerges from the diverging lens?



27 A thin converging lens of focal length 15 cm forms a real, inverted and magnified image of an object placed at a distance *u* from the lens.

What are the possible values of u?

5 cm

- II. 20 cm
- III. 25 cm
- IV. 30 cm

II and III

Β

C III and IV

D I, II and III

28 A ray of light passes through an unknown medium of refractive index 1.8 into air as shown below.



What is the angle between the refracted ray and the normal in air?

Α	16°	В	29°	С	34°	D	64°
	• •	_	-•	-	••	_	• •

- 29 Which of the following statements about ultra-sound is correct?
 - A Its frequency is above 200 kHz
 - **B** It is usually used in burglar alarm systems.
 - **C** It can be used to clean surgical instruments.
 - **D** It gives out ionising radiation when used in medical equipment.
- **30** The graph below shows how the air pressure varies as a sound wave passes through air.

Which of the following points on the graph represents a region of compression of the sound wave?



31 The diagram below shows two conducting spheres A and B of the same mass hanging from insulating threads of the same length. The charge of A is +5 C and the charge of B is +10 C. The electric forces on A and B are F₁ and F₂ respectively.



Which of the following statements about F1 and F2 and the angles x and y is correct?

- **A** $F_1 > F_2$ and x > y
- **B** $F_1 < F_2$ and x < y
- **C** $F_1 = F_2$ and x = y
- **D** $F_1 = F_2$ and x < y

For questions 32 and 33

The diagram shows part of a high voltage generator. The metal sphere of the generator is connected to the earth and an ammeter through a simple circuit. The ammeter, A records a steady current reading.



32 Which set of arrows correctly indicates the direction of electrons flow in the wires PQ and RS and the direction of current flow in the ammeter, A?

	electrons flow in wire PQ	current flow in ammeter A	electrons flow in wire RS
Α	1	\leftarrow	1
В	1	\rightarrow	↑
С	\rightarrow	\leftarrow	↑
D	\downarrow	\rightarrow	\downarrow

33 The voltage produced by the generator is 20 000 V. The ammeter records a current of 0.00060 A. If each electron carries a charge of 1.6 x 10⁻¹⁹ C, how many electrons passes through the ammeter in 2.0 s?

Α	3.3 x 10 ⁷	В	3.8 x 10 ¹⁵
С	7.5 x 10 ¹⁴	D	7.5 x 10 ¹⁵

- **34** An electric heater draws a current of 2.5 A when connected across an electrical source of 240 V. Assuming that the heater is 100 % efficient, how much electrical energy is converted into thermal energy by the heater in 1.5 minutes?
 - **A** 600 J **B** 900 J **C** 22 kJ **D** 54 kJ
- **35** The diagram below shows how a thermistor, a LDR and two identical resistors R₁ and R₂ are connected in a circuit. The voltages across the resistors R₁ and R₂ are measured by voltmeters V₁ and V₂ respectively.



How will the readings of voltmeters V_1 and V_2 be affected when the surroundings become colder and darker?

	voltmeter V ₁	voltmeter V ₂
Α	decreases	decreases
В	decreases	increases
С	increases	decreases
D	increases	increases

36 In the circuit shown, all five resistors have a resistance of 10 Ω. Which resistor(s) will have the lowest potential difference across it?



37 3 resistors and 4 fuses (fuse rating shown within the bracket) are connected together as shown in the circuit below.



When the switch is closed, which two fuses will blow?

- A F1 and F2 only
- ${\bm B} \qquad {F_1} \text{ and } {F_3} \text{ only} \\$
- C F1 and F4 only
- $\label{eq:relation} {\bm D} \qquad {\bm F}_3 \text{ and } {\bm F}_4 \text{ only}$
- **38** An air conditioner unit of rating "10 A, 240 V" and a light bulb of power 100 W are switched on for 4 hrs. What is the cost for using the air conditioner unit and the light bulb for 4 hrs if the unit cost is 2.5 cents?
 - **A** \$0.25 **B** \$0.31 **C** \$0.85 **D** \$2.56

39 Figure (I) shows a negative charge in an electric field and Figure (II) shows a current-carrying wire, placed at right angle to a magnetic field.



Which of the following shows the possible direction(s) of the forces acting on the unknown charge and the current-carrying conductor respectively?

	(I)	(II)
Α	force up	force left or right
В	force up	force up or down
С	force down	force left or right
D	force down	force up or down

40 The figure shows a cross-section of a paper cone used in a speaker. Coiled copper wires are attached to the paper cone. Direct current flows into the copper wires.



What is the direction of the force experienced by the coiled copper wires when current flows in them?

Α	up	В	down
С	left	D	right

- END OF PAPER -