

CANDIDATE NAME		
CG	INDEX NO	
PHYSICS		8867/01
Paper 1 Multiple Choice		13 Sept 2024
		1 hour
Additional Materials:	Multiple Choice Answer Sheet	

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

There are **thirty** 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.

Data

speed of light in free space	С	=	$3.00 \times 10^8 \text{ m s}^{-1}$
elementary charge	е	=	$1.60 \times 10^{-19} C$
unified atomic mass constant	u	=	1.66 × 10 ^{−27} kg
rest mass of electron	me	=	$9.11 imes 10^{-31} \text{ kg}$
rest mass of proton	$m_{ ho}$	=	$1.67 \times 10^{-27} \text{ kg}$
the Avogadro constant	NA	=	$6.02 \times 10^{23} \text{ mol}^{-1}$
gravitational constant	G	=	$6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
acceleration of free fall	g	=	9.81 m s⁻²
Formulae			

uniformly accelerated motion	S	=	$ut + \frac{1}{2}at^{2}$
	V^2	=	u² + 2as
resistors in series	R	=	$R_1 + R_2 + \dots$
resistors in parallel	$\frac{1}{R}$	=	$\frac{1}{R_1} + \frac{1}{R_2} + \dots$

Answer all questions.

1 A student estimates the maximum speed of four different moving objects.

Which maximum speed is not a reasonable estimate?

- A container ship: 10 m s⁻¹
- **B** Olympic sprinter: 0.1 km s⁻¹
- **C** racing car: 9000 cm s⁻¹
- **D** snail: 0.01 km h⁻¹
- **2** Rain is falling vertically down at a constant speed of 8.0 m s⁻¹. A passenger on a bus travelling at a constant velocity of 60 km h⁻¹ on a horizontal surface sees the side windowpane and the tracks caused by the rain.

At what angle does the rain track appear to be making from the vertical?

A 8°	° B	2	26°	С	64°	D	82°
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3 A set of repeated measurements is made of a fixed quantity. An average of these measurements is calculated.

What is the effect of averaging on the random error and the systematic error in the measurements?

- **A** Random error and systematic error are both reduced.
- **B** Random error and systematic error are both unaffected.
- **C** Random error is reduced but systematic error is unaffected.
- **D** Random error is unaffected but systematic error is reduced.

4 A parachutist falls from a stationary hot air balloon at time t = 0. The velocity–time graph for the parachutist from time t = 0 until the time when he is just above the ground is shown.



Which graph best shows the variation with time of the acceleration of the parachutist?



5 A projectile is fired from point P with velocity V at an angle θ to the horizontal. It lands at point Q, a horizontal distance R from P.



The acceleration of free fall is *g*. Air resistance is negligible.

Which of the following graphs correctly shows the variation with angle θ of the range *R*.



6 A cyclist takes off horizontally from a point 2.0 m above the surface of a pool of water, which is 2.5 m wide.



What is the cyclist's minimum take-off speed in order to clear the pool of water?

- **A** 2.8 m s^{-1} **B** 3.9 m s^{-1} **C** 5.5 m s^{-1} **D** 6.1 m s^{-1}
- 7 A 1.2 kg box is accelerated over 3.0 s as shown below.



8 A 5.0 kg mass is connected to a 3.0 kg mass by an inextensible string. They are hung over a frictionless pulley as shown. As the masses move, the 5.0 kg mass experiences 20 N of friction.



- 9 Which of the following statements correctly identify an action-reaction pair?
 - **A** The tension acting on two boys pulling on two ends of the same rope.
 - **B** The attractive force that an airplane exerts on the Earth and the weight of the airplane.
 - **C** The centripetal force on a car making a turn and the friction acting on the car.
 - **D** The thrust of a boat's propeller on the water and the buoyancy force of the water on the boat.
- A ball of weight *W* is held stationary on a slope with a force *R*.Which arrow represents the resultant force the slope exerts on the ball?



11 A 1.0 kg uniform rod of 2.0 m is pivoted from a wall at P. A mass of 5.0 kg is hung a distance *x* from P and the rod is supported by a string 1.8 m from P.



If the string is rated for a maximum tension of 20 N, what is the maximum value of *x* such that the string does not break?

Α	0.056 m	В	0.36 m	С	0.61 m	D	0.66 m
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12 A non-uniform rod PQ of length 1.0 m is placed on two electronic balances. The two balances give readings of 200 g and 500 g.



How far is the centre of gravity of the rod from the side P?

- **A** 0.29 m **B** 0.50 m **C** 0.71 m **D** 0.87 m
- **13** The graph below shows the variation of the force with compression for a spring.



Which of the following is closest to the compression required to store 0.90 J of potential energy in the spring?

A 0.05 III B 0.06 III C 0.07 III D 0.06	Α	0.05 m	В	0.06 m	С	0.07 m	D	0.08 m
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14 A crate of mass 50 kg is pushed a distance of 6.0 m along a horizontal surface against a constant resistive force of 70 N. The crate moves at a constant speed. It is then lifted slowly, at a constant speed, through a vertical distance of 1.2 m onto the back of a lorry.

What is the total work done in this process?

Α	420 J	В	480 J	С	590 J	D	1000 J
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15 A man lifts a weight of 480 N with a constant speed through a distance of 3.5 m using a rope and some pulleys. The man pulls on the rope with a force of 200 N and a length of 10.5 m passes through his hands.

What is the efficiency in percentage of the pulley system?

A 20% **B** 40% **C** 60% **D** 80%

- A body is moving in a uniform circular motion in a horizontal plane.Which of the following statements is correct?
 - **A** Both the angular velocity and the linear velocity are constant.
 - **B** Both the angular velocity and the kinetic energy are constant.
 - **C** Both the angular velocity and the linear momentum are constant.
 - **D** Both the linear velocity and the linear acceleration are constant.
- 17 Two block masses 3.0 kg and 6.0 kg are placed on the rough surface of a circular turntable at positions 2.0 m and 5.0 m respectively from the centre. The circular turntable is rotating about a vertical axis through its centre.

What is the ratio of the frictional force acting on the 3.0 kg mass to that on the 6.0 kg mass?

A 1:5 B 4:5 C 5:1 D)	5:4
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18 The Earth has a radius of 6.38×10^6 m and rotates about its axis once every 24 hours.



What is the linear speed of a person standing at a latitude θ of 30° on the surface of the Earth?

	Α	230 m s⁻¹	В	400 m s⁻¹	С	460 m s⁻¹	D	800 m s⁻
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An object in a space capsule orbiting the Earth seems to be floating.Which statement correctly describes the force(s) acting on the object?

- **A** There are no forces acting on the object.
- **B** The centripetal force on the object is equal and opposite to its weight.
- **C** The weight of the object is the only force acting on it.
- **D** The gravitational force is negligible.

20 The current *I* flowing through a component varies with the potential difference *V* across it as shown.



What is the variation with potential difference V of the component's resistance R?



21	The table shows the properties of two different wires,	P and Q.
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	length	resistance	resistivity of material
Wire P	l	R	ρ
Wire Q	2 l	$\frac{1}{4}R$	$\frac{1}{3}\rho$

Wire P has a cross-section of diameter *d*.

What is the diameter of the cross-section of wire Q?

Α	0.41 <i>d</i>	В	1.6 <i>d</i>	С	2.7d	D	7.1 <i>d</i>
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22 Six identical resistors are arranged in a circuit with two switches S_1 and S_2 .



Which of the following configuration of the two switches will give the largest effective resistance across terminals P and Q?

	switch S ₁	switch S ₂
Α	open	open
в	closed	open
С	open	closed
D	closed	closed

23 A potential divider circuit is set up across a 24 V supply, a fixed 20 k Ω resistor and a variable 0 – 50 k Ω resistor.



What is the range of values measured across the 20 k Ω resistor?

- A between 0 and 6.9 V
- B between 0 and 17 V
- C between 6.9 V and 24 V
- D between 17 V and 24 V
- **24** A long straight wire XY lies in the same plane as a square loop of wire PQRS which is free to move. The sides PS and QR are initially parallel to XY.



When currents start to flow in the wire and loop in the direction as shown in the diagram, what is the effect on the loop?

- A it moves towards the long wire
- B it moves away from the long wire
- C it rotates about an axis parallel to XY
- D it remains stationary

A particle is in a uniform field. The particle experiences a force in the opposite direction to the field.Which field is the particle in, and on which property of the particle is the field acting?

	field	property of particle on which the field acts			
Α	electric	positive charge			
В	electric	negative charge			
С	gravitational	mass			
D	gravitational	weight			

26 A long straight wire is placed on top of a coil. Currents I_1 and I_2 flows in the coil and wire respectively in the direction indicated in the diagram below.



What is the direction of the force on wire by the coil at P?

- A downwards
- **B** upwards
- **C** into the plane of the page
- **D** out of the plane of the page

27 Nine long vertical wires carry equal currents into or out of the page in the directions shown. Which arrow best shows the direction of the resultant force on the wire in the centre?



28 Carbon-14 decays to a Nitrogen-14 nucleus. The half-life of this decay is 5700 years. If a sample started out with Carbon-14 nuclei only, what is the value of the ratio <u>Number of Carbon-14 nuclei</u> after 17100 years? Number of Nitrogen-14 nuclei

A 0.125 **B** 0.143 **C** 0.500 **D** 7.00

- 29 α-particles and β-particles are two common types of radiation from radioactive sources.Which of the following statements about the two particles is incorrect?
 - **A** Both α -particles and β -particles can cause ionisation.
 - **B** Both α -particles and β -particles can be deflected by an electric field.
 - **C** Both α -particles and β -particles can pass through a thin sheet of paper.
 - **D** α -particle have a charge of +2e and β -particle have a charge of -1e.

14

30 The masses of a proton, neutron and ${}^{85}_{37}$ Rb nuclei are shown below.

	mass / u
⁸⁵ ₃₇ Rb	84.9118
proton	1.0073
neutron	1.0087

What is the mass defect of the $^{85}_{37}Rb$ nuclei?

Α	0.7087 u	В	0.7605 u	С	0.7759 u	D	0.8277 u
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