

# ANDERSON SERANGOON JUNIOR COLLEGE

## 2020 JC2 Preliminary Examination

**PHYSICS Higher 1** 

# 8867/01

Paper 1 Multiple Choice

Choice Answer Sheet.

Tuesday 22 September 2020

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 and class on the Multiple Choice Answer Sheet. Shade and write your NRIC/FIN.

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 Multiple

Read the instructions on the Multiple Choice 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 question paper. The use of an approved scientific calculator is expected, where appropriate.

#### Data

speed of light in free space,	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
elementary charge,	$e = 1.60 \times 10^{-19} \mathrm{C}$
unified atomic mass constant,	$u = 1.66 \times 10^{-27} \mathrm{kg}$
rest mass of electron,	$m_{\rm e} = 9.11 \times 10^{-31}  \rm kg$
rest mass of proton,	$m_{\rm p} = 1.67 \times 10^{-27}  \rm kg$
the Avogadro constant	$N_{\rm A} = 6.02 \times 10^{23}  {\rm mol}^{-1}$
gravitational constant	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
acceleration of free fall,	$g = 9.81 \text{ m s}^{-2}$

### Formulae

uniformly accelerated motion,	$s = ut + \frac{1}{2} at^2$
	$v^2 = u^2 + 2as$
resistors in series,	$R = R_1 + R_2 + \dots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \dots$

- 1 What is a reasonable estimate of the mass of a raindrop?
  - **A**  $10^{1}$  kg **B**  $10^{-1}$  kg **C**  $10^{-3}$  kg **D**  $10^{-5}$  kg
- 2 A student makes the following measurements to determine the density of a plastic ruler.

length =  $31.2 \pm 0.1$  cm cross-sectional area =  $0.32 \pm 0.02$  cm<sup>2</sup> mass =  $13.78 \pm 0.01$  g

Which statement is correct?

- **A** The actual uncertainty of density is  $0.03 \text{ g cm}^{-3}$ .
- **B** The fractional uncertainty of density is 0.031.
- **C** The percentage uncertainty of density is 6.6 %.
- **D** The density of the plastic ruler is expressed as  $1.38 \pm 0.07$  g cm<sup>-3</sup>.

**3** A passenger in a car travelling due East at speed  $v_{\rm C}$  sees a motorcyclist travelling due North–West at speed  $v_{\rm M}$ .



Which diagram shows the velocity  $v_{R}$  of the motorcyclist relative to the passenger on the car?



4 The acceleration-time graph of an object in a straight line is as shown. The object was initially at rest.

Which point on the graph does the object has the largest speed?



5 A student throws two stones from the top of a cliff overlooking a lake.



The stones have identical initial speed  $v_0$ .

Stone 1 is thrown at an angle  $\theta$  below the horizontal, while stone 2 is thrown at the same angle  $\theta$  above the horizontal. Air resistance is assumed to be negligible.

Which of the following statements is true?

- A Both stones strike the water with the same velocity.
- **B** Stone 1 strikes the water with a greater speed than stone 2.
- **C** Stone 2 strikes the water with a greater speed than stone 1.
- **D** Both stones strike the water with the same speed but at a different angle above the water surface.
- 6 A ball is dropped from the window of an apartment located at the tenth storey of a high-rise building. After 1 second from the time of release, the ball was observed to have fallen exactly 2 storeys.

At which storey will the ball be 2 seconds after it was released?

**A** 2<sup>nd</sup> **B** 4<sup>th</sup> **C** 6<sup>th</sup> **D** 8<sup>th</sup>

7 A man is skiing down a slope with constant speed.

According to Newton's third law, which force makes an action-reaction pair with the weight of the man?

- **A** the friction from the slope
- **B** the normal contact force from the slope
- **C** the gravitational force on the Earth due to the man
- **D** the sum of normal contact force and friction from the slope
- 8 Two identical blocks move towards each other with speed *v* on a smooth surface.



The blocks collide inelastically.

Which statement is correct?

- A The relative speed of separation is 2*v*.
- **B** The two blocks stick together after collision.
- **C** The sum of momentum after collision is less than the sum of momentum before collision.
- **D** The sum of momentum after collision is the same as the sum of momentum before collision.
- 9 The area under the graph represents the impulse during a collision.



**10** A child sits on a car seat which is moving horizontally at constant speed.

Which vector best represents the force that the seat exerts on the child?



**11** Four forces act on the corners of a rigid square, resting on a frictionless surface.

In which situation will the square be in equilibrium?



**12** A force of 1.0 N is initially applied to a spring with spring constant 3.5 N m<sup>-1</sup>. The force is then increased and the spring extends by a further 40 cm.

How much extra work is done in producing the additional extension?

- **A** 0.023 J **B** 0.14 J **C** 0.28 J **D** 0.68 J
- **13** A uniform meter rule is supported by a knife-edge at the 40 cm mark and a string at the 100 cm mark. The string passes round a frictionless pulley and carries a mass of 20 g as shown in the diagram.



If a 50 g mass is now hung on the string, at which mark on the rule must the knife-edge be supported so that the meter rule will remain in equilibrium?

Α	14 cm	В	25 cm	С	32 cm	D	36 cm
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**14** A steel ball is released from rest in a tall cylinder of oil.

Which graph shows variation with time of the gravitational potential energy,  $E_p$  and the kinetic energy,  $E_k$  of the ball?



An old-fashioned 60 W lamp converts 95 % of its energy supply into heat.A 4.0 W modern lamp has the same power output of light as the old-fashioned lamp.

What is the efficiency of the modern lamp?

A :	5.0 %	В	6.7 %	С	75 %	D	95 %
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**16** The engine of a car has maximum output power of 54 kW. The air resistance acting on the car when it is moving with speed *v* is  $cv^2$ , where *c* is 2.0 kg m<sup>-1</sup>.

What is the maximum speed that can be achieved by the car on level road?

**A**  $3.0 \text{ m s}^{-1}$  **B**  $5.0 \text{ m s}^{-1}$  **C**  $30 \text{ m s}^{-1}$  **D**  $160 \text{ m s}^{-1}$ 

**17** A body is moving in a uniform circular motion.

Which of the following statement is correct?

- A Both angular velocity and linear velocity are constant.
- **B** The kinetic energy is constant but linear velocity varies.
- **C** Both angular velocity and linear momentum are constant.
- **D** The linear momentum is constant but the kinetic energy varies.
- **18** A passenger is sitting in a railway carriage facing the direction in which the train is travelling. A pendulum hangs down in front of him from the carriage roof. The train travels along a circular arc bending to the left.

Which one of the following diagrams shows the position of the pendulum as seen by the passenger, and the directions of the forces acting on it?



**19** A marble slides up a hump along a smooth track. The top of the hump is part of an arc with a radius of curvature 5.0 cm.



What is the maximum speed of the marble at the top of the hump such that it does not leave the track?

- **A**  $0.49 \text{ m s}^{-1}$  **B**  $0.70 \text{ m s}^{-1}$  **C**  $0.99 \text{ m s}^{-1}$  **D**  $1.4 \text{ m s}^{-1}$
- **20** The Earth has a radius of  $6.38 \times 10^6$  m, and rotates on its axis once every 24 hours.



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

- **A** 230 m s<sup>-1</sup> **B** 400 m s<sup>-1</sup> **C** 540 m s<sup>-1</sup> **D**  $8.4 \times 10^5$  m s<sup>-1</sup>
- 21 Which of the following is a possible charge on a particle?

**A**  $3.20 \times 10^{-20}$  C **B**  $4.00 \times 10^{-19}$  C  $1.68 \times 10^{-18}$  C  $3.04 \times 10^{-17}$  C

22 Three identical lamps P, Q and R are connected as shown in the diagram. Each lamp operates at normal brightness and the ammeter (of negligible resistance) registers a steady current.



The filament of lamp Q breaks. What happens to the ammeter reading and the brightness of the remaining lamps?

	ammeter reading	brightness of lamp P	brightness of lamp R
Α	increases	increases	decreases
В	increases	decreases	increases
С	decreases	increases	decreases
D	decreases	decreases	increases

**23** Four wires are made of the same metal. The cross-sectional area, length and thermodynamic temperature of the wires are shown.

Which wire has the smallest resistance?

	cross-sectional area	length	temperature
Α	А	L	Т
В	А	3L	37
С	3 <i>A</i>	L	Т
D	3 <i>A</i>	L	37

**24** A battery of e.m.f. 10 V with an internal resistance of 2.0  $\Omega$  delivers a current through a load of variable resistance.

What is the maximum power delivered to the load?

**A** 5.0 W **B** 13 W **C** 25 W **D** 50 W

**25** A battery of e.m.f. *E* and internal resistance *r* delivers a current *I* through a variable resistance *R*.



R is set at two different values and the corresponding currents I are measured using an ammeter of negligible resistance.

R/Ω	<i>I /</i> A
3.0	1.00
12.0	0.40

What is the value of the internal resistance r?

<b>Α</b> 1.3 Ω <b>Β</b>	<b>3</b> .0 Ω <b>C</b>	6.0 Ω	D	$13 \Omega$
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**26** In the circuit below, the reading  $V_T$  on the voltmeter changes as the temperature of the thermistor changes. The reading  $V_L$  on the voltmeter changes as the light intensity on the light-dependent resistor (LDR) changes.



The readings on  $V_T$  and  $V_L$  are both high.

What are the conditions of temperature and light intensity?

	temperature	light intensity
Α	high	high
В	high	low
С	low	high
D	low	low

27 In the circuit shown, all the resistors are identical and all the ammeters have negligible resistance.



The reading  $A_4$  is 0.6 A.

What are the readings on the other ammeters?

	A1/A	<i>A</i> <sub>2</sub> / A	A <sub>3</sub> /A
Α	0.4	1.2	0.2
В	0.3	1.5	0.6
С	0.6	1.8	0.6
D	0.9	3.3	1.8

**28** In an electric motor, current *I* passes through a rectangular coil of wire which is in a region of uniform magnetic field *B*.



Which of the following describes the rotation of the coil (viewed from the front along the axis of rotation as shown in the figure) through a quarter of a rotation?

	direction of rotation of coil	torque
Α	clockwise	decreases
В	clockwise	constant
С	anticlockwise	decreases
D	anticlockwise	constant

**29** Protons, each of mass *m* and charge *e*, follow a circular path when travelling perpendicular to a magnetic field of uniform flux density *B*.

What is the time for one complete orbit?



**30** A small compass shows the direction of earth's magnetic field when placed near a wire with no current initially.



At which point will the resultant magnetic flux density likely be zero when a current into the plane of paper is passed through the wire?

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