

DUNMAN HIGH SCHOOL Promotional Examination Year 5

H2 PHYSICS

Section A Multiple Choice Questions Additional Materials: Multiple Choice Answer Sheet 9749 27 September 2022 30 minutes

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name at the top of this page.

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

There are **fifteen** 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.

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

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

Write your name and class on the Multiple Choice Answer Sheet. Write and shade the Index Number as follows.

WRITE SHADE APPROPRIATE BOXES Т 0 1 2 3 4 5 6 7 8 9 9 Ν For illustration only: D 4 6 Ω 1 2 3 5 7 8 9 9 ĒX **___** ____ A student from class 4 6 7 8 q 2 3 5 0 5C99, with index 7 Ν -Ü 7 Ω 1 2 3 4 5 6 8 9 number 02, should 2 Μ shade "9902". B В С D Е F G Н Α Т Ε R

This document consists of 9 printed pages and 1 blank page.

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Data

С	=	3.00 × 10 ⁸ m s⁻¹
μ_0	=	$4\pi \times 10^{-7} \text{ H m}^{-1}$
E0	=	$8.85 \times 10^{-12} \mathrm{F m}^{-1}$
	=	(1/(36π)) × 10 ⁻⁹ F m ⁻¹
е	=	1.60 × 10 ⁻¹⁹ C
h	=	6.63 × 10 ^{−34} J s
и	=	1.66 × 10 ⁻²⁷ kg
m _e	=	9.11 × 10 ⁻³¹ kg
$m_{ m p}$	=	1.67 × 10 ^{−27} kg
R	=	8.31 J K ⁻¹ mol ⁻¹
N _A	=	6.02 × 10 ²³ mol ⁻¹
k	=	1.38 × 10 ⁻²³ J K ⁻¹
G	=	$6.67 \times 10^{-11} \mathrm{N} \mathrm{m}^2 \mathrm{kg}^{-2}$
g	=	9.81 m s ⁻²
	c μ ₀ ε h u m _P R N _A k G g	$c =$ $\mu_0 =$ $\epsilon_0 =$ $e =$ $h =$ $u =$ $m_e =$ $m_p =$ $R =$ $N_A =$ $k =$ $G =$ $g =$

Formulae

uniformly accelerated motion,	s	=	$ut + \frac{1}{2}at^2$
	V ²	=	u² + 2as
work done on/by a gas,	W	=	$\rho\Delta V$
hydrostatic pressure,	р	=	hogh
gravitational potential,	ϕ	=	-Gm/r
temperature,	T/K	=	<i>T</i> /⁰C + 273.15
pressure of an ideal gas,	p	=	$\frac{1}{3}\frac{Nm}{V} < c^2 >$
mean translational kinetic energy of an ideal gas molecule,	Е	=	$\frac{3}{2}kT$
displacement of particle in s.h.m.,	x	=	x ₀ sin ωt
velocity of particle in s.h.m.,	V	=	$v_0 \cos \omega t$
electric current,	Ι	=	$\pm \omega \sqrt{x_o^2 - x^2}$ Anvq
resistors in series,	R	=	$R_1 + R_2 + \ldots$
resistors in parallel,	1/R	=	$1/R_1 + 1/R_2 + \dots$
electric potential,	V	=	$\frac{Q}{4\pi\varepsilon_{o}r}$
alternating current / voltage,	x	=	x₀ sin <i>∞t</i>
magnetic flux density due to a long straight wire,	В	=	$\frac{\mu_0 I}{2\pi d}$
magnetic flux denxity due to a flat circular coil,	В	=	$\frac{\mu_0 NI}{2r}$
magnetic flux density due to a long solenoid,	В	=	$\mu_0 nI$
radioactive decay,	x	=	$x_0 \exp(-\lambda t)$
decay constant,	λ	=	$\frac{\ln 2}{t_{\frac{1}{2}}}$

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9749

[Turn over

1 Four students each made a series of measurements of the acceleration of free fall *g*. The table below shows the results obtained.

student		results,	g / m s ⁻²	
Α	9.81	9.79	9.84	9.83
В	9.81	10.52	9.89	8.94
С	9.45	9.21	8.99	8.76
D	8.45	8.46	8.50	8.41

Which student obtained a set of results that could be described as precise but not accurate?

2 The equation connecting object distance *u*, image distance *v* and focal length *f* for a lens is

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{v}.$$

A student measures values of u and v, with their associated uncertainties. These are

 $u = (50 \pm 3) \text{ mm}$

$$v = (200 \pm 5)$$
 mm.

What is the uncertainty in the value of f?

- A 2.1 mm B 3.4 mm C 4.5 mm D 6.8 mm
- 3 An object is dropped, from rest, 10.0 m above the surface of some water.

Assuming negligible air resistance, what is the time taken to reach the water and the speed with which the object enters the water?

	time / s	speed / m s ⁻¹
Α	1.02	10.0
В	1.02	14.0
С	1.43	10.0
D	1.43	14.0

4 A single horizontal force *F* is applied to a block X which is in contact with a separate block Y, as shown.



The blocks remain in contact as they accelerate along a horizontal frictionless surface. Air resistance is negligible. X has a greater mass than Y.

Which statement is correct?

- **A** The acceleration of X is equal to force *F* divided by the mass of X.
- **B** The force that X exerts on Y is equal to *F*.
- **C** The force that X exerts on Y is less than *F*.
- **D** The force that X exerts on Y is less than the force that Y exerts on X.
- 5 A moving object X with speed *v* approaches head-on towards a stationary object Y as shown.



The two objects collide elastically. After the collision, Y moves to the right with speed 0.67 v.

What is the speed of X after the collision?

A 0 **B** 0.33 v **C** 0.67 v **D** v

6 A sample is placed on a tensile testing machine. The graph below shows the variation of the tension applied on the sample with its extension.



What is the extension in the sample when the work done on it is 4.4 J?

A 6.0 cm **B** 8.0 cm **C** 10.0 cm **D** 12.0 cm

7 A balloon inflated with helium gas is suspended in air. The total mass of the balloon, helium and load is 80.0 kg. The density of air is about 0.00123 g cm⁻³.

Which of the following is the best estimate for the volume of the balloon?

A 65 m ³ B 65 cm ³ C 638 m ³ D 63	38 cm ³
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8 A ball is thrown vertically upwards.

Neglecting air resistance, which statement is correct?

- A The potential energy of the ball increases uniformly with time during the ascent.
- **B** The kinetic energy of the ball is greatest at the greatest height attained.
- **C** The total energy of the ball is constant throughout its motion.
- **D** The momentum of the ball is constant throughout its motion.

9 Three masses, each of magnitude 1.0 kg, are fixed to a rod of negligible mass.



The rod rotates in a horizontal plane about a pivot at a constant angular velocity of 2.0 rad s⁻¹.

What is the horizontal force exerted on the pivot by the rod?

	A 1.8 N	В	2.4 N	С	36 N	D	48 N
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10 The planet Jupiter has satellites called lo and Europa which have different orbital radii and orbital time periods. The table shows the orbital radii for lo and Europa and the orbital time period of lo.

	radius / 10⁵ km	period / days
lo	4.22	1.77
Europa	6.71	?

What is the orbital time period of Europa?

\mathbf{A} 0.00 days \mathbf{D} 2.4 days \mathbf{C} 2.0 days \mathbf{D} 3.5 da	Α	0.88 days	В	2.4 days	С	2.8 days	D	3.5 day
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11 When a graph of temperatures in kelvin against temperatures in degrees Celsius is plotted, a linear graph is obtained.

What is the vertical intercept and gradient of this line?

	vertical intercept	gradient
А	-273.15	1
В	0	1 / 273.15
С	0	273.15
D	273.15	1

12 Two glass bulbs, X of volume 0.300 m³ and Y of volume 0.600 m³, are connected by a fine tube of negligible volume. A valve prevents gas from flowing between the two bulbs. Both bulbs have a pressure of 1.00 × 10⁵ Pa and a temperature of 25.0 °C initially. Bulb Y is then heated to a temperature of 150.0 °C, and the valve is subsequently opened.



What is the new pressure in the system when the valve is opened?

- A 0.95 × 10⁵ Pa
- **B** 1.25 × 10⁵ Pa
- **C** 1.42 × 10⁵ Pa
- **D** 2.25×10^{5} Pa
- **13** In an experiment to determine the specific latent heat of vaporisation of an unknown liquid X, a student heats liquid X with an electric heater until the liquid boils off completely. The student notes down the following data from the experiment.

mass of liquid heated	300 g
specific heat capacity of liquid X	1800 J kg ⁻¹ K ⁻¹
initial temperature of liquid X	27°C
boiling point of liquid X	85°C
electrical power of heater	2.0 kW
time of heating	270 s

Assuming all the thermal energy produced by the heater is fully absorbed by liquid X, what is the specific latent heat of vaporisation of liquid X?

Α	510 kJ kg⁻¹	В	1700 kJ kg⁻¹	С	1800 kJ kg⁻¹	D	1900 kJ kg ⁻¹
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9749

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14 A body undergoes simple harmonic motion. The graph shows the variation of the displacement of the body with time.



Which description of the velocity of the body at point P is correct?

- A maximum velocity, moving upwards
- **B** maximum velocity, moving downwards
- **C** zero velocity, accelerating upwards
- **D** zero velocity, accelerating downwards
- **15** A mass attached to a string oscillates as a simple pendulum.

Which row correctly shows the displacement of the mass from its equilibrium position, its kinetic energy and the restoring force acting on it at the same instant?

	displacement	kinetic energy	restoring force
А	0	0	maximum
В	0	maximum	0
С	maximum	0	0
D	maximum	maximum	maximum

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10