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DUNMAN HIGH SCHOOL Promotional Examination Year 5

H2 PHYSICS

9749

Section A Multiple Choice Questions

27 September 2022

Additional Materials: Multiple Choice Answer Sheet

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.

For illustration only:

A student from class 5C99, with index number 02, should shade "9902".

WRITE		SHADE APPROPRIATE BOXES									
INDEX NUMBER	9	0	1	2	3	4	5	6	7	8	9
	9	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒
	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒
	2	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
		A	B	C	D	E	F	G	H	I	

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

Data

speed of light in free space,	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
permeability of free space,	$\mu_0 = 4\pi \times 10^{-7} \text{ H m}^{-1}$
permittivity of free space,	$\epsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1}$ $= (1/(36\pi)) \times 10^{-9} \text{ F m}^{-1}$
elementary charge,	$e = 1.60 \times 10^{-19} \text{ C}$
the Planck constant,	$h = 6.63 \times 10^{-34} \text{ J s}$
unified atomic mass constant,	$u = 1.66 \times 10^{-27} \text{ kg}$
rest mass of electron,	$m_e = 9.11 \times 10^{-31} \text{ kg}$
rest mass of proton,	$m_p = 1.67 \times 10^{-27} \text{ kg}$
molar gas constant	$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
the Avogadro constant,	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
the Boltzmann constant,	$k = 1.38 \times 10^{-23} \text{ J K}^{-1}$
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,

$$s = ut + \frac{1}{2}at^2$$

work done on/by a gas,

$$v^2 = u^2 + 2as$$

$$W = p\Delta V$$

hydrostatic pressure,

$$p = \rho gh$$

gravitational potential,

$$\phi = -Gm/r$$

temperature,

$$T/K = T/^{\circ}\text{C} + 273.15$$

pressure of an ideal gas,

$$p = \frac{1}{3} \frac{Nm}{V} \langle c^2 \rangle$$

mean translational kinetic energy of an ideal gas molecule,

$$E = \frac{3}{2}kT$$

displacement of particle in s.h.m.,

$$x = x_0 \sin \omega t$$

velocity of particle in s.h.m.,

$$v = v_0 \cos \omega t$$

$$= \pm \omega \sqrt{x_0^2 - x^2}$$

electric current,

$$I = Anvq$$

resistors in series,

$$R = R_1 + R_2 + \dots$$

resistors in parallel,

$$1/R = 1/R_1 + 1/R_2 + \dots$$

electric potential,

$$V = \frac{Q}{4\pi\epsilon_0 r}$$

alternating current / voltage,

$$x = x_0 \sin \omega t$$

magnetic flux density due to a long straight wire,

$$B = \frac{\mu_0 I}{2\pi d}$$

magnetic flux density due to a flat circular coil,

$$B = \frac{\mu_0 NI}{2r}$$

magnetic flux density due to a long solenoid,

$$B = \mu_0 nI$$

radioactive decay,

$$x = x_0 \exp(-\lambda t)$$

decay constant,

$$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$$

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

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

student	results, $g / \text{m s}^{-2}$			
A	9.81	9.79	9.84	9.83
B	9.81	10.52	9.89	8.94
C	9.45	9.21	8.99	8.76
D	8.45	8.46	8.50	8.41

- 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

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

$$v = (200 \pm 5) \text{ mm}.$$

What is the uncertainty in the value of f ?

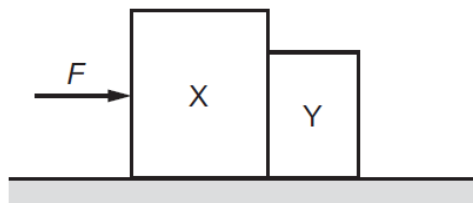
- A** 2.1 mm **B** 3.4 mm **C** 4.5 mm **D** 6.8 mm

- 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}
A	1.02	10.0
B	1.02	14.0
C	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.

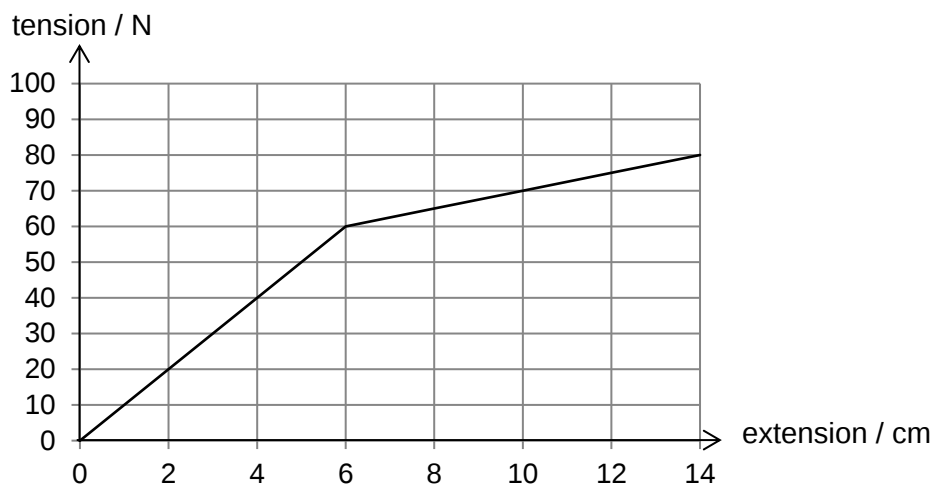


The two objects collide elastically. After the collision, Y moves to the right with speed $0.67 v$.

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 $0.00123 \text{ g cm}^{-3}$.

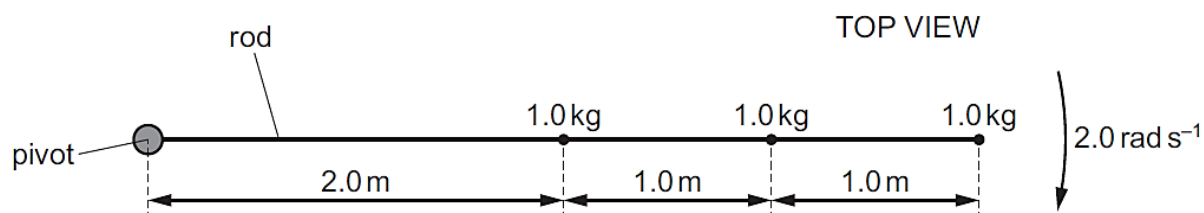
Which of the following is the best estimate for the volume of the balloon?

- A** 65 m^3 **B** 65 cm^3 **C** 638 m^3 **D** 638 cm^3
- 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 **B** 2.4 N **C** 36 N **D** 48 N
- 10 The planet Jupiter has satellites called Io and Europa which have different orbital radii and orbital time periods. The table shows the orbital radii for Io and Europa and the orbital time period of Io.

	radius / 10^5 km	period / days
Io	4.22	1.77
Europa	6.71	?

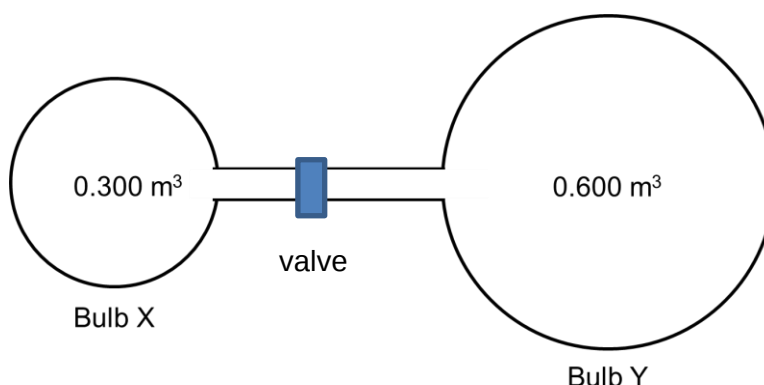
What is the orbital time period of Europa?

- A** 0.88 days **B** 2.4 days **C** 2.8 days **D** 3.5 days
- 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
A	-273.15	1
B	0	$1 / 273.15$
C	0	273.15
D	273.15	1

- 12** Two glass bulbs, X of volume 0.300 m^3 and Y of volume 0.600 m^3 , 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 $1.00 \times 10^5 \text{ Pa}$ 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?

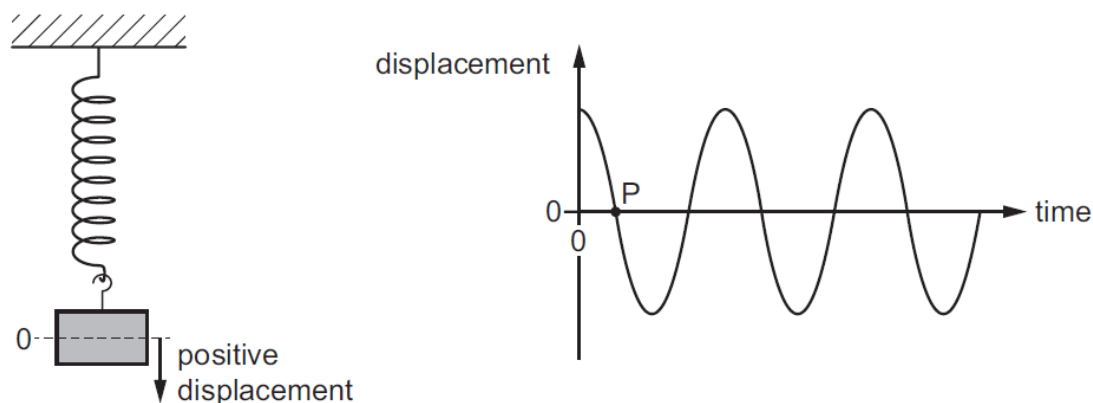
- A** $0.95 \times 10^5 \text{ Pa}$
B $1.25 \times 10^5 \text{ Pa}$
C $1.42 \times 10^5 \text{ Pa}$
D $2.25 \times 10^5 \text{ Pa}$
- 13** In an experiment to determine the specific latent heat of vaporisation of an unknown liquid X, a student heats liquid X with an electric heater until the liquid boils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

mass of liquid heated	300 g
specific heat capacity of liquid X	$1800 \text{ J kg}^{-1} \text{ K}^{-1}$
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?

- A** 510 kJ kg^{-1} **B** 1700 kJ kg^{-1} **C** 1800 kJ kg^{-1} **D** 1900 kJ kg^{-1}

- 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
A	0	0	maximum
B	0	maximum	0
C	maximum	0	0
D	maximum	maximum	maximum

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