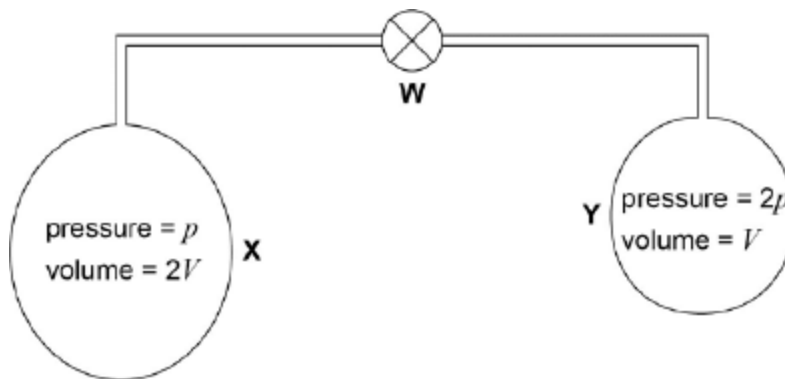


1

X and **Y** are two gas bottles that are connected by a tube that has negligible volume compared with the volume of each bottle.



Initially the valve **W** is closed.

X has a volume $2V$ and contains hydrogen at a pressure of p .

Y has a volume V and contains hydrogen at a pressure of $2p$.

X and **Y** are both initially at the same temperature.

W is now opened. Assuming that there is no change in temperature, what is the new gas pressure?

A $\frac{2}{3}p$

B $\frac{5}{3}p$

C $\frac{4}{3}p$

D $\frac{3}{2}p$

(Total 1 mark)

2

Which of the following is equal to $\frac{\text{radius of a nucleus of } {}_{51}^{125}\text{Sb}}{\text{radius of a nucleus of } {}_{20}^{64}\text{Zn}}$??

A 1.19

B 1.25

C 1.33

D 1.40

(Total 1 mark)

3

After 64 days the activity of a radioactive nuclide has fallen to one sixteenth of its original value. The half-life of the radioactive nuclide is

A 2 days.

B 4 days.

C 8 days.

D 16 days.

(Total 1 mark)

4

Which of the following best describes the decay constant for a radioisotope?

A The reciprocal of the half-life of the radioisotope.

B The rate of decay of the radioisotope.

C The constant of proportionality which links half-life to the rate of decay of nuclei.

D The constant of proportionality which links rate of decay to the number of undecayed nuclei.

(Total 1 mark)

5

A fixed mass of gas occupies a volume V . The temperature of the gas increases so that the root mean square velocity of the gas molecules is doubled.

What will the new volume be if the pressure remains constant?

A $\frac{V}{2}$

B $\frac{V}{\sqrt{2}}$

C $2V$

D $4V$

(Total 1 mark)

6

A radioactive nucleus emits a β^- particle then an α particle and finally another β^- particle. The final nuclide is

A an isotope of the original element

B the same element with a different proton number

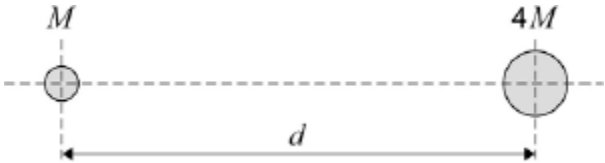
C a new element of higher proton number

D a new element of lower nucleon number

(Total 1 mark)

7

Two stars of mass M and $4M$ are at a distance d between their centres.



The resultant gravitational field strength is zero along the line between their centres at a distance y from the centre of the star of mass M .

What is the value of the ratio $\frac{y}{d}$?

- A $\frac{1}{2}$
- B $\frac{1}{3}$
- C $\frac{2}{3}$
- D $\frac{3}{4}$

(Total 1 mark)

8

A liquid flows continuously through a chamber that contains an electric heater. When the steady state is reached, the liquid leaving the chamber is at a higher temperature than the liquid entering the chamber. The difference in temperature is Δt .

Which of the following will increase Δt with no other change?

- A Increasing the volume flow rate of the liquid
- B Changing the liquid to one with a lower specific heat capacity
- C Using a heating element with a higher resistance
- D Changing the liquid to one that has a higher density

(Total 1 mark)

9

A simple pendulum and a mass-spring system have the same oscillation frequency f at the surface of the Earth. The pendulum and the mass-spring system are taken down a mine where the acceleration due to gravity is less than at the surface. What is the change in the frequency of the simple pendulum and the change in the frequency of the mass-spring system?

	simple pendulum	mass-spring	
A	f increases	f decreases	<input type="checkbox"/>
B	f decreases	f decreases	<input type="checkbox"/>
C	f increases	f stays unchanged	<input type="checkbox"/>
D	f decreases	f stays unchanged	<input type="checkbox"/>

(Total 1 mark)**10**

Which of the following statements about Newton's law of gravitation is correct?

Newton's gravitational law explains

- A** the origin of gravitational forces.
- B** why a falling satellite burns up when it enters the Earth's atmosphere.
- C** why projectiles maintain a uniform horizontal speed.
- D** how various factors affect the gravitational force between two particles.

(Total 1 mark)

11

A planet has a radius half the Earth's radius and a mass a quarter of the Earth's mass. What is the approximate gravitational field strength on the surface of the planet?

A 1.6 N kg⁻¹

B 5.0 N kg⁻¹

C 10 N kg⁻¹

D 20 N kg⁻¹

(Total 1 mark)

12

Which of the following gives a correct unit for $\left(\frac{g^2}{G}\right)$?

A N

B N kg⁻¹

C N m

D N m⁻²

(Total 1 mark)

13

The frequency of a body moving with simple harmonic motion is doubled. If the amplitude remains the same which of the following is also doubled?

A The time period.

B The total energy.

C The maximum velocity.

D The maximum acceleration.

(Total 1 mark)

14

A particle oscillates with undamped simple harmonic motion.

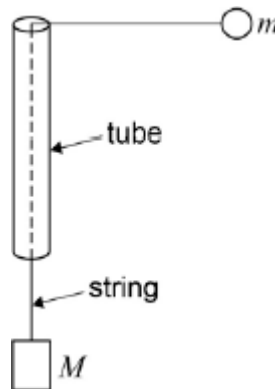
The acceleration of the particle

- A is always in the opposite direction to its velocity.
- B decreases as the potential energy increases.
- C is proportional to the frequency.
- D is least when the speed is greatest.

(Total 1 mark)

15

A string passes through a smooth thin tube. Masses m and M are attached to the ends of the string. The tube is moved so that the mass m travels in a horizontal circle of constant radius r and at constant speed v .



Which of the following expressions is equal to M ?

- A $\frac{mv^2}{2r}$
- B mv^2rg
- C $\frac{mv^2}{rg}$
- D $\frac{mv^2g}{r}$

(Total 1 mark)