Diploma Programme
Programme du diplôme
Programa del Diploma

Physics
Standard level
Paper 1A

5 November 2025

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

1 hour 30 minutes [Paper 1A and Paper 1B]

Instructions to candidates

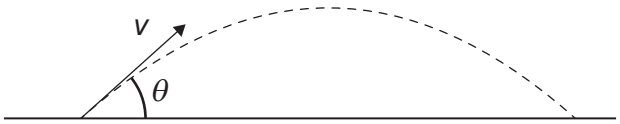
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- A calculator is required for this paper.
- A clean copy of the **physics data booklet** is required for this paper.
- The maximum mark for paper 1A is **[25 marks]**.
- The maximum mark for paper 1A and paper 1B is **[45 marks]**.

8825–6710
13 pages

1. A person walks 40 m due west and then 30 m due north. The total walking time is 100 s. What are the average speed and the magnitude of the average velocity of the person?

	Average speed / m s^{-1}	**Magnitude of average velocity / m s^{-1}**
A.	0.5	0.5
B.	0.5	0.7
C.	0.7	0.5
D.	0.7	0.7

2. A projectile is launched with an initial velocity v at an angle θ above the horizontal. The projectile lands at the same height from which it was released. Air resistance is negligible.



What is the time of flight of the projectile?

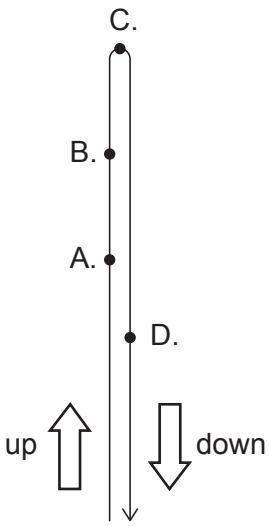
A. $\dfrac{v\sin\theta}{g}$

B. $\dfrac{2v\sin\theta}{g}$

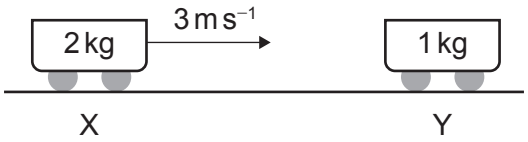
C. $\dfrac{2v\cos\theta}{g}$

D. $\dfrac{2v\sin\theta\cos\theta}{g}$

3. A ball is thrown vertically upwards. Air resistance is **not** negligible. Four positions of the ball are shown: A and B on the way up, C at the maximum height, and D on the way down. At which position does the acceleration of the ball have its greatest magnitude?



4. Cart X, of mass 2 kg, is moving at a speed of 3 m s^{-1} to the right and collides on a horizontal track with cart Y of mass 1 kg. Y is initially stationary.



The velocity of Y immediately after the collision is 4 m s^{-1} to the right. What is the velocity of X immediately after the collision?

A. 1 m s^{-1} to the right

B. 1 m s^{-1} to the left

C. 2 m s^{-1} to the right

D. 2 m s^{-1} to the left

5. 0.25 J of work is done to compress a spring by a distance of 0.10 m from its unstretched length. What is the spring constant?

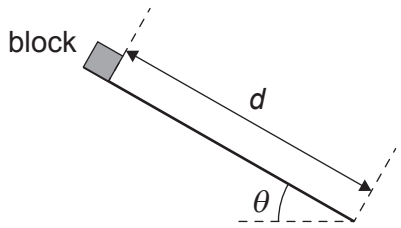
A. 2.5 N m^{-1}

B. 5.0 N m^{-1}

C. 25 N m^{-1}

D. 50 N m^{-1}

6. A block of mass m is released from rest and slides down a ramp of length d that makes an angle θ with the horizontal. A constant frictional force F acts on the block.



What is the kinetic energy of the block at the bottom of the ramp?

A. $mgd - Fd\cos\theta$

B. $mgd - Fd$

C. $mgd\sin\theta - Fd\cos\theta$

D. $mgd\sin\theta - Fd$

7. Two blocks P and Q of the same mass are placed in thermal contact with each other until they reach thermal equilibrium. In reaching thermal equilibrium the temperature of P increases by 10 K, and the temperature of Q decreases by 20 K. Thermal energy exchange with the surroundings is negligible.

Which statement is correct?

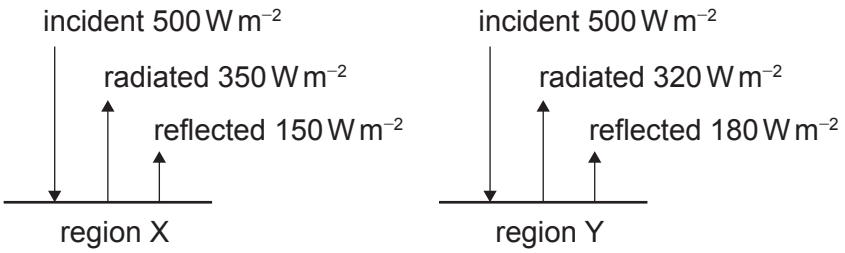
A. P has a greater specific heat capacity than Q.

B. Q has a greater specific heat capacity than P.

C. The magnitude of the change in internal energy is greater for P than for Q.

D. The magnitude of the change in internal energy is greater for Q than for P.

8. The diagram shows the incident, radiated and reflected intensities of the solar radiation for two regions X and Y on the surface of Earth. X and Y have the same surface temperature.



Which region has a greater albedo, and which region has a greater emissivity?

	Greater albedo	Greater emissivity
A.	X	X
B.	Y	X
C.	X	Y
D.	Y	Y

9. Which process involving gas molecules in the Earth's atmosphere is the main cause of the greenhouse effect?

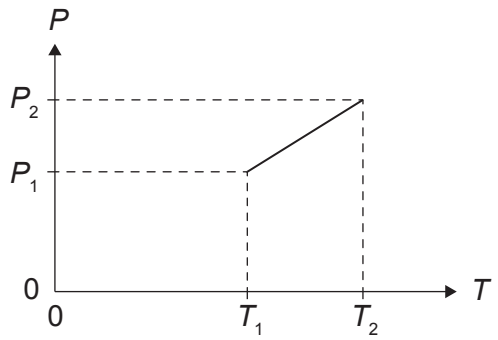
A. Reflection of incoming solar radiation

B. Absorption and re-radiation of incoming solar radiation

C. Reflection of outgoing infrared radiation

D. Absorption and re-radiation of outgoing infrared radiation

10. A sample of n moles of an ideal gas is kept at a constant volume. The graph shows how the pressure P of the gas varies with absolute temperature T.



What is the volume of the gas?

A. $nR\dfrac{T_2 - T_1}{P_2 - P_1}$

B. $nR\dfrac{P_2 - P_1}{T_2 - T_1}$

C. $nR\left(\dfrac{T_2}{P_2} - \dfrac{T_1}{P_1}\right)$

D. $nR\left(\dfrac{P_2}{T_2} - \dfrac{P_1}{T_1}\right)$

11. Two containers are filled with monatomic gas of equal mass at the same temperature. One container holds helium and the other neon.

The mass of a neon atom is five times the mass of a helium atom.

What is $\dfrac{\text{internal energy of the helium gas}}{\text{internal energy of the neon gas}}$?

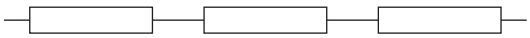
A. $\dfrac{1}{5}$

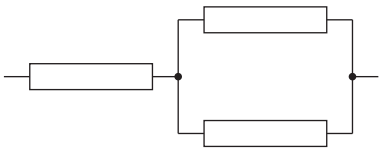
B. 1

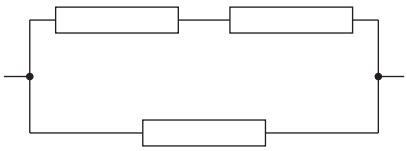
C. $\sqrt{5}$

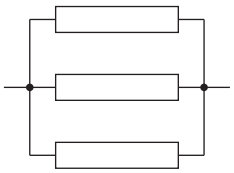
D. 5

12. Three identical resistors are arranged in four different networks. The same potential difference is applied across each network. Which network dissipates the greatest electrical power?

A. 

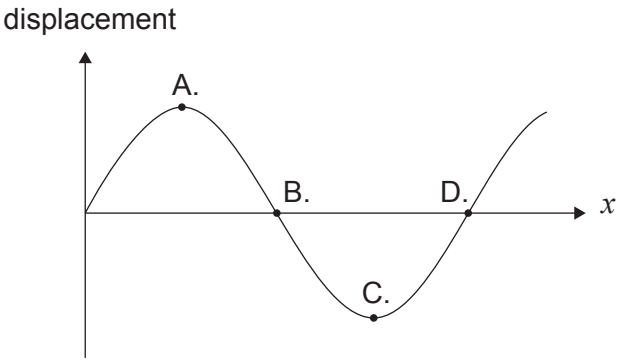
B. 

C. 

D. 

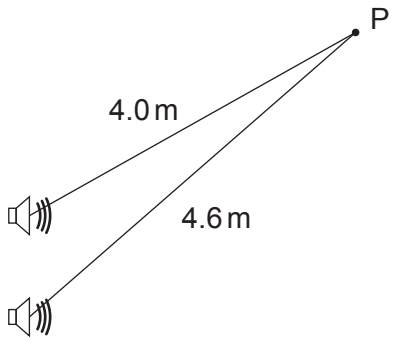
13. The graph shows how the displacement of a wave varies with the position x along the wave. The wave travels towards positive x.

At the instant shown, which point along the wave has the maximum positive velocity?



14. Two loudspeakers are driven in phase and emit sound of the same frequency. A minimum intensity of sound is detected at point P.

P is 4.0 m from one loudspeaker and 4.6 m from the other.



What is a possible wavelength of the sound?

A. 20 cm

B. 30 cm

C. 40 cm

D. 60 cm

15. A standing sound wave is formed in a pipe of length L that is open at both ends. The standing wave has two nodes. What is the wavelength of the standing wave?

A. $\frac{L}{2}$

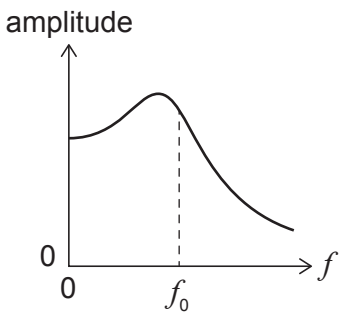
B. $\frac{2L}{3}$

C. L

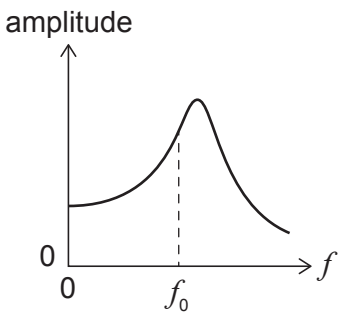
D. $2L$

16. A heavily damped oscillator of natural frequency f_0 is driven by a periodic force of frequency f. Which graph shows how the amplitude of the oscillations varies with f?

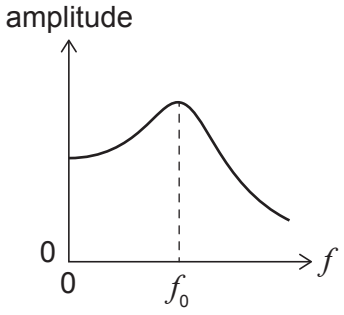
A.



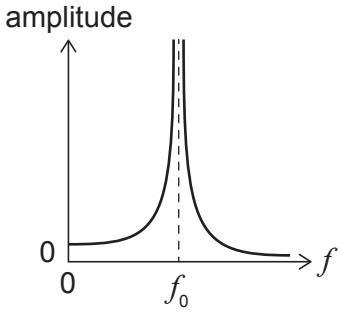
B.



C.



D.



17. Planets X and Y orbit the same star.

The orbital radius of planet X is R_X, and that of planet Y is R_Y. The orbital period of planet X is T_X, and that of Y is T_Y.

What is $\frac{T_Y}{T_X}$?

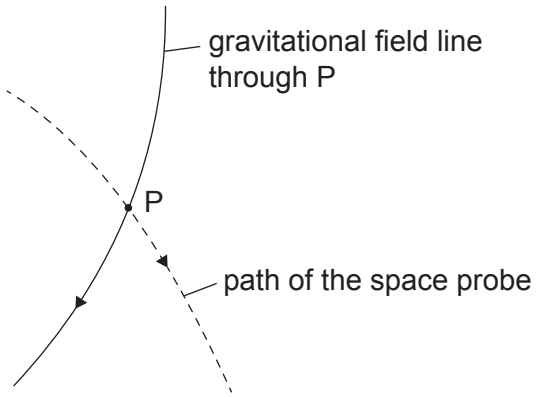
A. $\left(\frac{R_Y}{R_X}\right)^{\frac{3}{2}}$

B. $\left(\frac{R_X}{R_Y}\right)^{\frac{3}{2}}$

C. $\left(\frac{R_Y}{R_X}\right)^{\frac{2}{3}}$

D. $\left(\frac{R_X}{R_Y}\right)^{\frac{2}{3}}$

18. A space probe moves in a gravitational field. No other forces than the gravitational force act on the probe. At one instant, the probe is at point P. The diagram shows the path of the probe and the gravitational field line through P.



What is the direction of the acceleration of the probe at P?

A. Tangent to the path of the probe

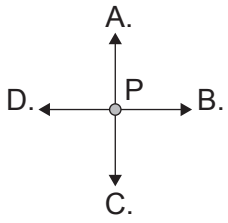
B. Perpendicular to the path of the probe

C. Tangent to the gravitational field line through P

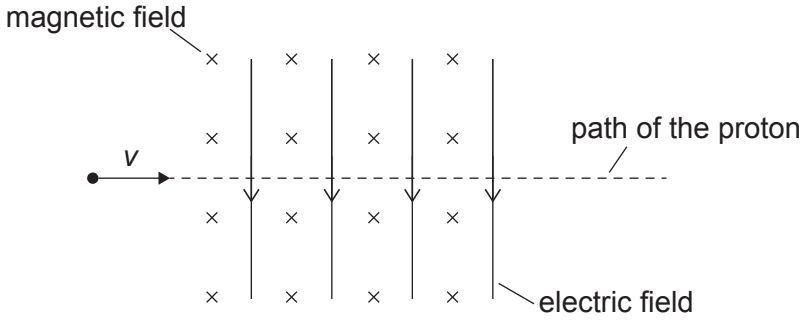
D. Perpendicular to the gravitational field line through P

19. Two point charges, $-Q$ and $+Q$, are placed as shown. Point P is at the same distance from both charges.

What is the direction of the electric field strength at P?



20. A proton enters a region where electric and magnetic fields are perpendicular to each other. The initial velocity v of the proton is perpendicular to both fields. The path of the proton is not deflected in the fields.



The proton is replaced by an alpha particle that is also not deflected by the fields. What is the velocity of the alpha particle?

A. $\frac{v}{2}$

B. v

C. $2v$

D. $4v$

21. Which claim about the structure of the atom is falsified by the results of the Geiger–Marsden–Rutherford experiment?

A. The nucleus is only made up of positively charged particles.

B. The electrons in the atom move in orbits of fixed radius.

C. The positive charge occupies all of the atom's volume.

D. The electrons in the atom have continuous energy.

22. Radioactive oxygen-15 ($^{15}_{8}O$) decays according to the following equation:

$$^{15}_{8}O \rightarrow X + \beta^{+} + \nu_{e}$$

What are the proton number and the nucleon number of nuclide X?

	Proton number of X	Nucleon number of X
A.	7	14
B.	9	14
C.	7	15
D.	9	15

23. The table shows how the count rate from a sample of a radioactive nuclide varies with time *t*. The nuclide has a half-life of 50 s.

***t*/s**	**Count rate/s^{-1}**
0	72
50	40

What is the background count rate?

A. Zero

B. $8\,s^{-1}$

C. $16\,s^{-1}$

D. $24\,s^{-1}$

24. A nucleus of uranium-235 ($^{235}_{92}U$) absorbs a neutron and decays into two nuclides, xenon-140 ($^{140}_{54}Xe$) and strontium-94 ($^{94}_{38}Sr$).

How many neutrons are released in this reaction?

A. 1

B. 2

C. 3

D. 4

25. The stellar parallax method involves a measurement of...

A. the peak wavelength of radiation from a star.

B. the frequency shift of the lines in a stellar spectrum.

C. the position of a star in the sky at different times of year.

D. the intensity of radiation from a star at different wavelengths.