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 – 6722
12 pages

1. A stone is released from rest and falls vertically. Air resistance is negligible. What is correct about the stone during each consecutive second of its motion?

A. The change in velocity is constant.

B. The change in displacement is constant.

C. The change in acceleration decreases.

D. The change in speed increases.

2. A projectile is launched horizontally from the top of a cliff with a speed of $10\,m\,s^{-1}$. The projectile hits the ground at a distance of 30 m from the base of the cliff. Air resistance is negligible.

What is the height of the cliff?

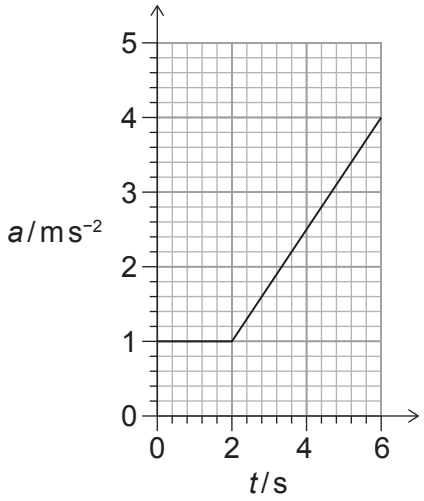
A. 15 m

B. 30 m

C. 45 m

D. 90 m

3. A force is applied to a mass of 3 kg. The graph shows the variation with time t of the acceleration a of the mass.



What is the average force acting on the mass?

A. 5 N

B. 6 N

C. 12 N

D. 24 N

4. An object of mass m, moving with a speed v, collides with a stationary object of mass m. The objects stick together.

What is the change in kinetic energy in the collision?

A. Zero

B. $\frac{mv^2}{8}$

C. $\frac{mv^2}{4}$

D. $\frac{3mv^2}{8}$

5. A pump has efficiency η when raising water from a well of depth d. The mass of water raised per second is R. Changes in kinetic energy of the water are considered negligible.

What is the input power to the pump required to raise the water?

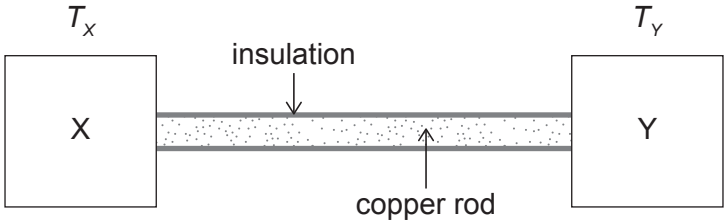
A. $\frac{Rd}{\eta g}$

B. $\frac{\eta R}{gd}$

C. ηRgd

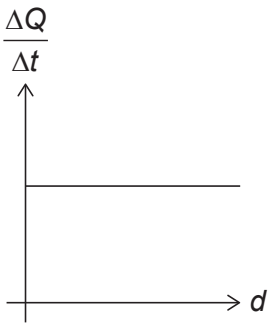
D. $\frac{Rdg}{\eta}$

6. Insulated solid copper rods of different diameters and fixed length are placed in thermal contact with two objects X and Y, maintained at different temperatures T_X and T_Y respectively. The diagram shows the setup with one such rod.



Which graph shows the variation with rod diameter d of the rate of thermal energy transfer $\frac{\Delta Q}{\Delta t}$ along the rod?

A.



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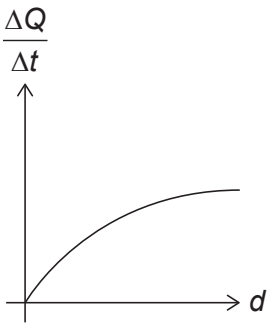

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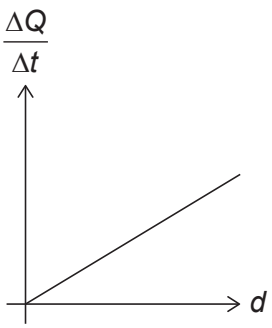

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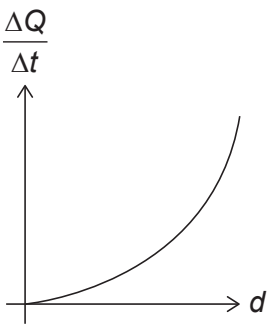


7. 80 g of a liquid are heated with a constant power output of 100 W. All the power goes into the liquid. After 60 s, the rise in temperature is 50 K.

What is the specific heat capacity of the liquid in $J\,kg^{-1}\,K^{-1}$?

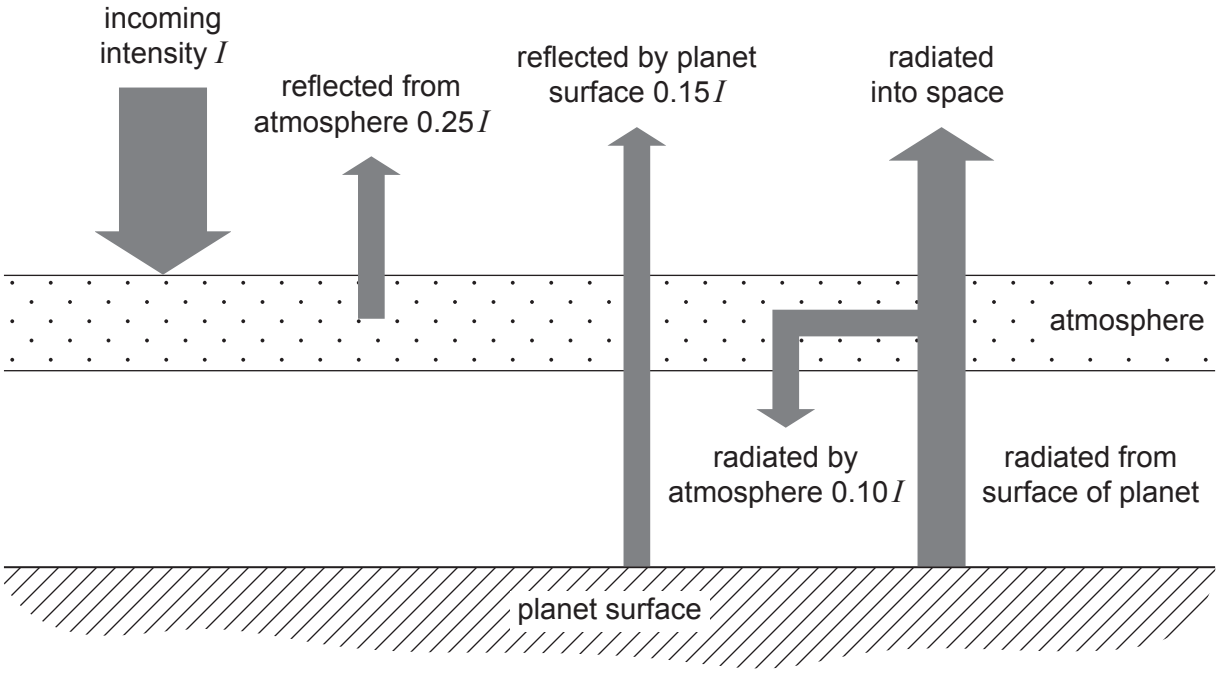
A. 120

B. 960

C. 1200

D. 1500

8. The energy balance model of a planet's climate is shown. The reflected and radiated intensities are given in terms of the incident incoming intensity I.



What is the radiated intensity from the surface of the planet?

A. $0.40\,I$

B. $0.50\,I$

C. $0.70\,I$

D. $1.10\,I$

9. A rigid vessel of volume V contains N molecules of an ideal monatomic gas. The average kinetic energy of the molecules is E_k. What is the pressure in the vessel?

A. $\dfrac{2N}{3VE_k}$

B. $\dfrac{2NE_k}{3V}$

C. $\dfrac{3N}{2VE_k}$

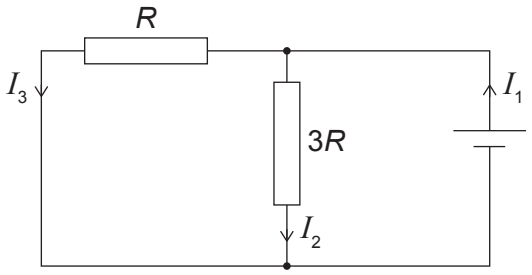
D. $\dfrac{3NE_k}{2V}$

10. A substance changes from a liquid into a solid without a change in temperature.

What is true about the internal energy of the substance and the total intermolecular potential energy of the substance when this phase change occurs?

	Internal energy of the substance	**Total intermolecular potential energy of the substance**
A.	decrease	decrease
B.	no change	decrease
C.	decrease	no change
D.	no change	no change

11. In the circuit shown, the cell has negligible internal resistance.



Which equation is correct?

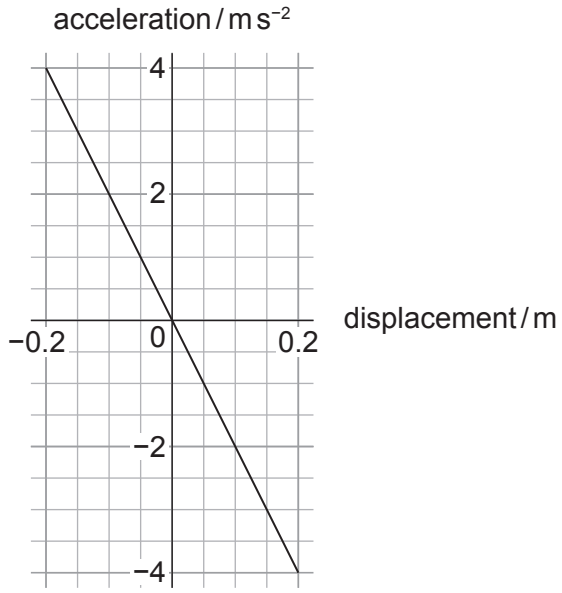
A. $I_1 = 4(I_2 + I_3)$

B. $I_1 = 4I_2$

C. $I_3 = 4I_2$

D. $I_3 = \frac{4I_1}{3}$

12. An object undergoes simple harmonic motion with frequency f. The graph shows the variation of its acceleration with displacement.



What is the value of f^2 in s^{-2}?

A. $\frac{5}{\pi^2}$

B. $\frac{5}{\pi}$

C. $\frac{100}{\pi^2}$

D. $\frac{100}{\pi}$

13. A sound wave in air is directed towards a water boundary, and part of it is refracted.

Three statements are made about the refracted wave compared to the incident wave.

I. The wavelength is different.

II. The amplitude is different.

III. The frequency is different.

Which of the statements are correct?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

14. The critical angle for light passing from a medium into air is 30°.

What is the approximate value for the speed of light in the medium?

A. $0.5 \times 10^8 \, m s^{-1}$

B. $1.5 \times 10^8 \, m s^{-1}$

C. $2.0 \times 10^8 \, m s^{-1}$

D. $2.6 \times 10^8 \, m s^{-1}$

15. A string that is fixed at both ends oscillates in the second harmonic with frequency 100 Hz. What other harmonic frequencies, in Hz, can this string oscillate at?

A. 25 and 50

B. 25 and 75

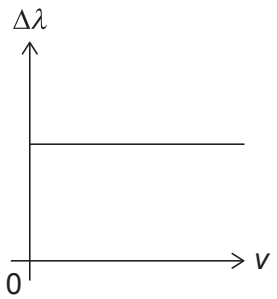
C. 50 and 150

D. 75 and 150

16. A source moving with speed v away from a stationary observer emits light of wavelength λ. The wavelength received by the observer is $\lambda + \Delta\lambda$. The speed v is much less than the speed of light.

Which graph gives the variation of $\Delta\lambda$ with v?

A.



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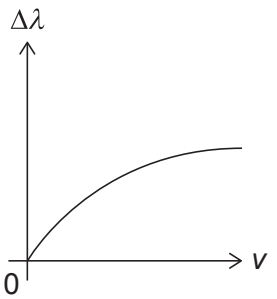

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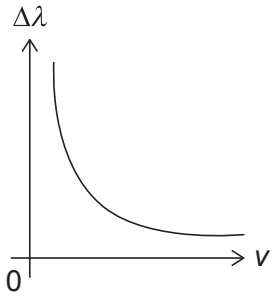
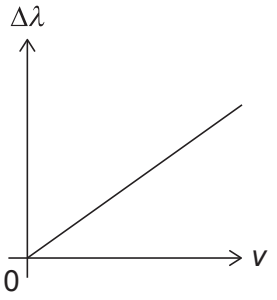


D.



17. Which is a statement of one of Kepler's laws of orbital motion?

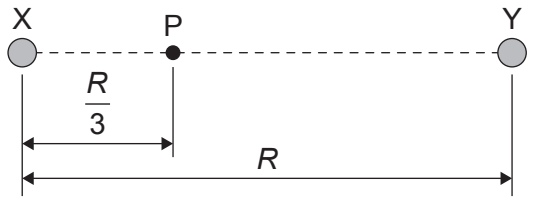
A. The square of the planet's orbital period is proportional to the cube of the length of the semi-major axis of its orbit.

B. A line segment joining a planet and the Sun sweeps out equal arc lengths during equal intervals of time.

C. A planet's orbital period is proportional to the cube of the length of the semi-major axis of its orbit.

D. The orbit of a planet is an ellipse with the Sun positioned at the centre.

18. Isolated planets X and Y have masses M_X and M_Y respectively and are separated by a distance R. A point P is located at a distance $\frac{R}{3}$ from planet X, as shown. The gravitational field strength at P is zero.



What is $\frac{M_Y}{M_X}$?

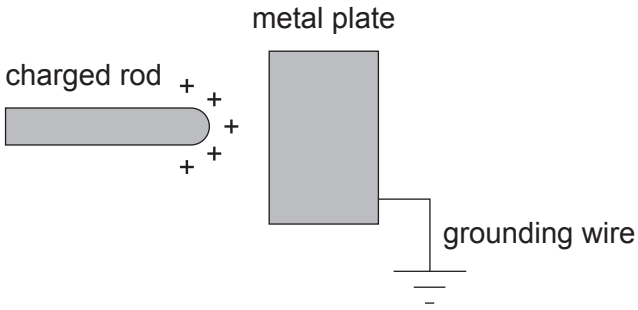
A. 2

B. 3

C. 4

D. 9

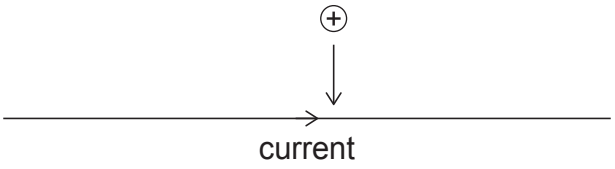
19. A positively charged rod is near a metal plate that is grounded as shown.



The grounding wire and then the rod are removed. What is correct about the overall charge on the plate before and after grounding is removed?

	Charge on plate before grounding is removed	Charge on plate after grounding is removed
A.	neutral	neutral
B.	neutral	negative
C.	negative	neutral
D.	negative	negative

20. A positively charged particle is moving towards a current-carrying wire as shown.



What is the direction of the magnetic force acting on the charged particle?

A. To the right

B. To the left

C. Into the page

D. Out of the page

21. Three statements are made about emission and absorption spectra.

I. They provide information on the chemical composition of substances.

II. They provide evidence for mass-energy equivalence.

III. They arise from transitioning electrons between energy levels.

Which of the statements are correct?

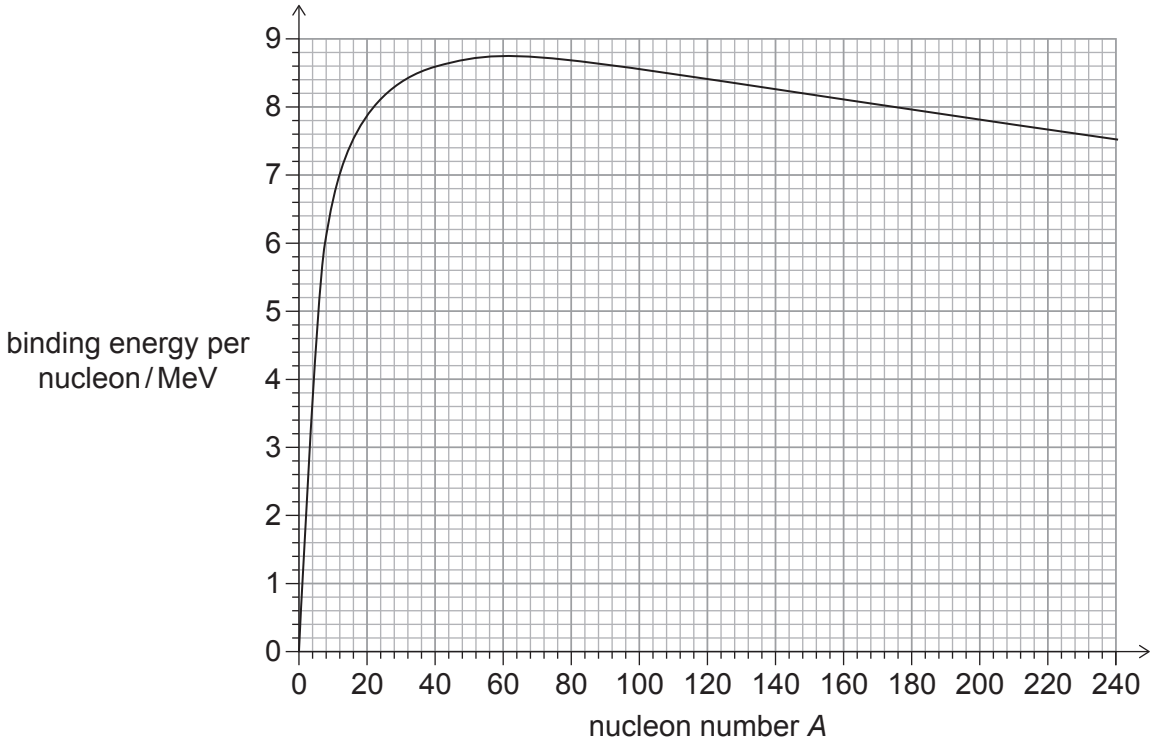
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

22. A graph of the variation with nucleon number *A* of the binding energy per nucleon is shown.



What is the approximate total energy, in MeV, needed to completely separate the nucleons of a $^{180}_{72}Hf$ nucleus?

A. 580

B. 620

C. 1440

D. 2020

23. Which two components of a nuclear power station are primarily responsible for ensuring that a controlled chain reaction is maintained?

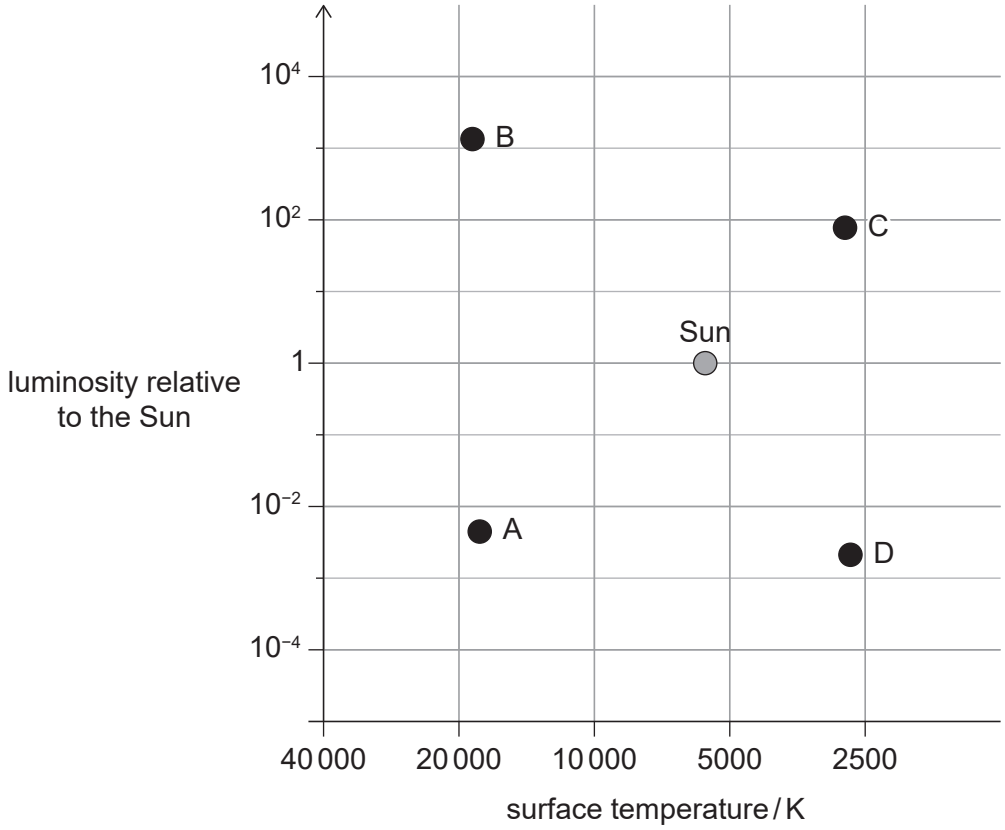
A. Control rods and heat exchangers

B. Moderators and shielding

C. Shielding and heat exchangers

D. Moderators and control rods

24. The Sun and positions of four stars A, B, C and D are plotted on the grid of a Hertzsprung–Russell (HR) diagram. Which star is a white dwarf?



25. A star is found to have a parallax angle of 0.25 arc-seconds. What is the distance to the star in light years?

A. 4.0

B. 13

C. 6.0×10^{11}

D. 38×10^{15}