Classification of Particles

TOPIC QUESTIONS

Level	AS Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min

1. A muon and an antimuon annihilate to produce the minimum number of photons.

What is the maximum wavelength of the photons?

A 5.9×10^{-15} m

B 1.2×10^{-14} m

C 5.9×10^{-9} m

D 1.2×10^{-8} m

2. Which row describes the nature of the strong nuclear force between two nucleons at separationsof 0.25 fm, 2.0 fm and 8.0 fm?

	At a separation of 0.25 fm	**At a separation of 2.0 fm**	**At a separation of 8.0 fm**
A	attractive	repulsive	negligible
B	repulsive	attractive	attractive
C	negligible	repulsive	attractive
D	repulsive	attractive	negligible

3. What are the products when a free neutron decays?

A $p + e^- + \nu_e$

B $p + e^+ + \bar{\nu}_e$

C $p + e^- + \bar{\nu}_e$

D $p + e^+ + \nu_e$

4. In a Young's double-slit experiment, monochromatic light is incident on two narrow slits and the resulting interference pattern is observed on a screen.

Which change **decreases** the fringe separation?

A decreasing the separation between the two slits

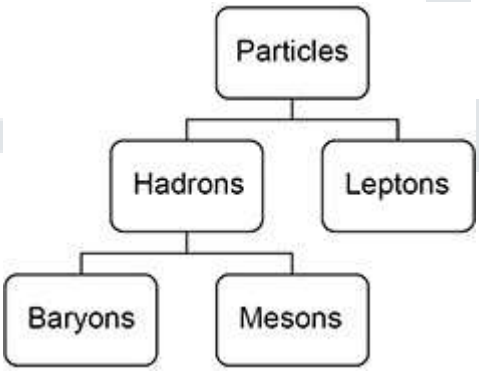
B increasing the distance between the slits and the screen

C using monochromatic light of higher frequency

D using monochromatic light of longer wavelength

5. Which shows the classification of particles?

A



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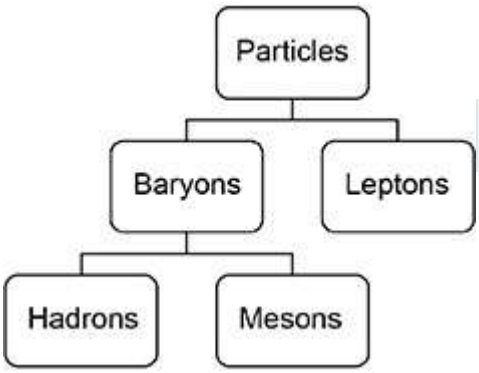

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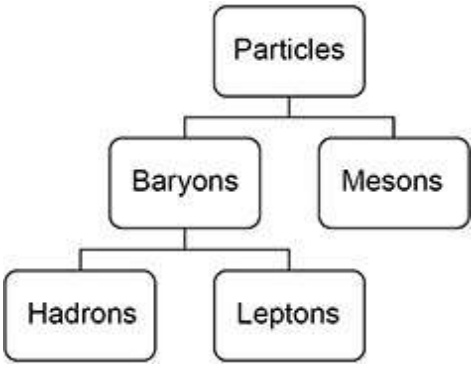

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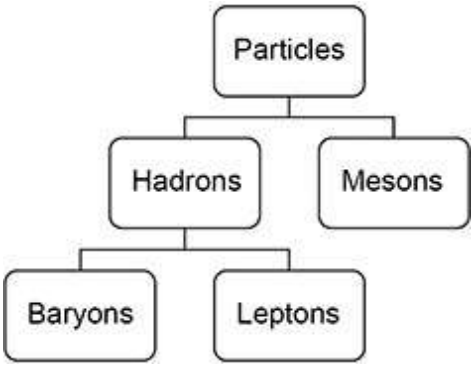


A

B

C

D

6. An electron collides with an isolated atom and raises an atomic electron to a higher energy level.Which statement is correct?

A The colliding electron is captured by the nucleus of the atom.

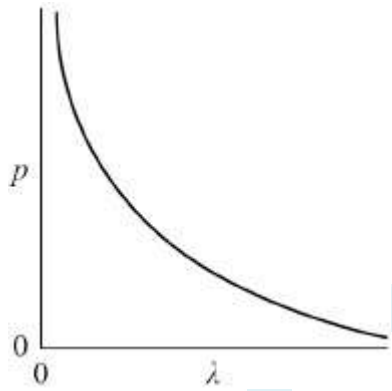
B A photon is emitted when the electron rises to the higher energy level.

C An electron is emitted when the excited electron returns to the ground state.

D The colliding electron transfers energy to the atomic electron.

7. Which graph shows the variation of momentum p with wavelength λ of a photon?

A



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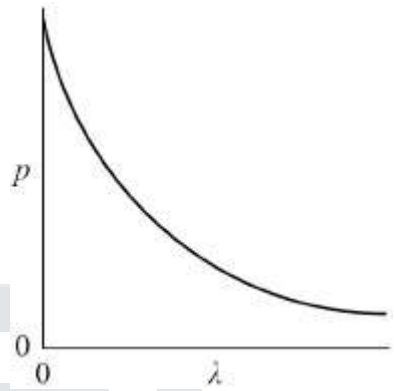

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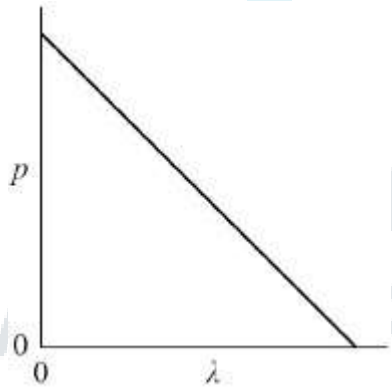

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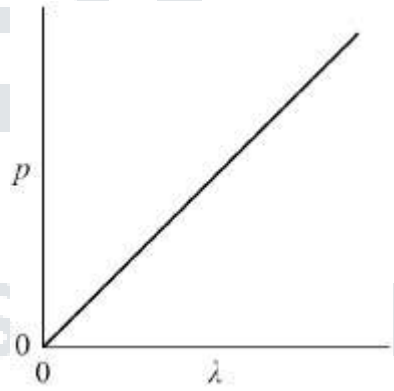


A

B

C

D

8. Photons of energy 1.0×10^{-18} J are incident on a metal surface and cause the emission ofelectrons from the metal surface.

Which statement about the emitted electrons is correct?

A They each have a kinetic energy of 1.0×10^{-18} J.

B They each have a kinetic energy that is a multiple of 1.0×10^{-18} J.

C Their mean kinetic energy is 1.0×10^{-18} J.

D The kinetic energy of each must be less than 1.0×10^{-18} J.

9. Evidence of the wave-like properties of electrons is

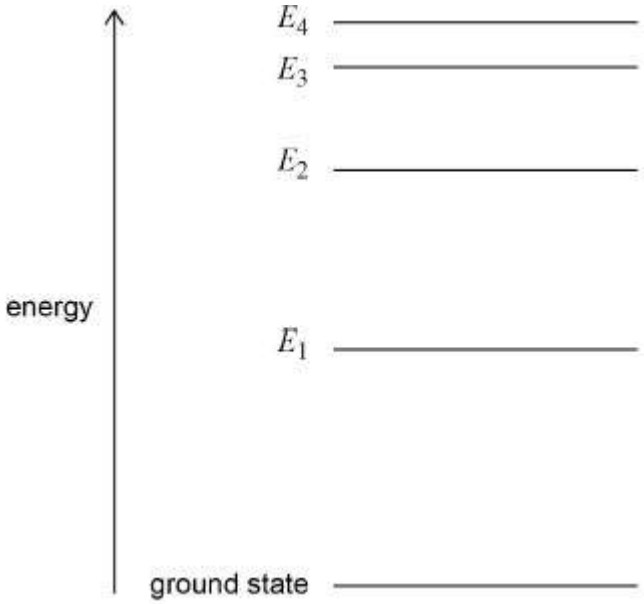
A the emission of electrons when short-wavelength light falls on a metal surface.

B the movement of electrons in an electric current.

C the diffraction of electrons by a metal crystal.

D the annihilation of an electron with a positron.

10. The diagram shows the energy levels in an atom drawn to scale. A transition from E_4 to E_2 causes the emission of a photon of green light.



Which transition could cause the emission of a photon of red light?

A E_2 to E_1

B E_3 to E_1

C E_3 to E_2

D E_4 to E_1

11. An electron collides with a neutral atom and ionizes it. Which of the following describes theparticles present after the collision?

A An electron and an excited atom.

B An excited atom containing an excess electron.

C Two electrons and a positive ion.

D Two electrons and a neutral atom in the ground state.

12. 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

13. Interference maxima produced by a double source are observed at a distance of 1.0 m from thesources. In which one of the following cases are the maxima closest together?

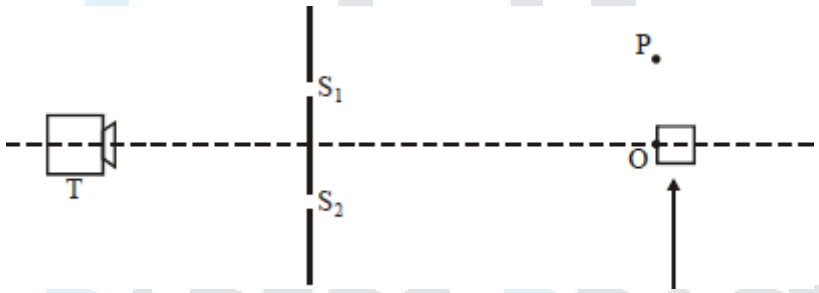
A red light of wavelength 700 nm from sources 4.0 mm apart

B sound waves of wavelength 20 mm from sources 50 mm apart

C blue light of wavelength 450 nm from sources 2.0 mm apart

D surface water waves of wavelength 10 mm from sources 200 mm apart

14. The diagram shows a microwave transmitter T which directs microwaves of wavelength eat twoslits S_1 and S_2 formed by metal plates. The microwaves that pass through the two slits are detected by a receiver.



receive
rat O

When the receiver is moved to P from O, which is equidistant from S_1 and S_2, the signal received decreases from a maximum to a minimum. Which one of the following statements is a correct deduction from this observation?

A The path difference $S_1O - S_2O = 0.5\,\lambda$

B The path difference $S_1O - S_2O = \lambda$

C The path difference $S_1P - S_2P = 0.5\,\lambda$

D The path difference $S_1P - S_2P = \lambda$

15.

Point sources of sound of the same frequency are placed at S_1 and S_2. When a sound detector is slowly moved along the line PQ, consecutive maxima of sound intensity are detected at W and Yand consecutive minima at X and Z. Which one of the following is a correct expression for the wavelength of the sound?

A $S_1X - S_1W$

B $S_1Y - S_1X$

C $S_1X - S_2X$

D $S_1Y - S_2Y$

16. Light of wavelength λ is incident normally on a diffraction grating for which adjacent lines are adistance 3λ apart. What is the angle between the second order maximum and the straight-through position?

A 9.6°

B 20°

C 42°

D There is no second order maximum.

(Total 1 mark)

17. Light of wavelength λ is incident normally on a diffraction grating of slit separation 4λ. What is theangle between the second order maximum and third order maximum?

A 14.5°

B 18.6°

C 48.6°

D 71.4°

18. A narrow beam of monochromatic light falls on a diffraction grating at normal incidence. The second order diffracted beam makes an angle of 45° with the grating. What is the highest ordervisible with this grating at this wavelength?

A 2

B 3

C 4

D 5

19. Monochromatic light of wavelength 590 nm is incident normally on a plane diffraction grating having 4×10^5 lines m^{-1}. An interference pattern is produced. What is the highest order visible in this interference pattern?

A 2

B 3

C 4

D 5

20. Using a diffraction grating with monochromatic light of wavelength 500 nm incident normally, a student found the 2nd order diffracted maxima in a direction at 30° to the central bright fringe. What is the number of lines per metre on the grating?

A 2×10^4

B 2×10^5

C 4×10^5

D 5×10^5