



1. One of this author's plays sets a scene in a supermarket, where every shopper has died frozen in their last act of shopping, after Efrossimov's camera proves to be the only defense against a gas attack. Another of his plays depicts the year 2222, where faucets will dispense grain alcohol, after the hapless engineer Rein's accidental travel into the future in an attempt to fix a faulty time machine brings Ivan the Terrible to the present day. In another play by this author, the sound of the "Internationale" is heard from offstage at the end, once the German and White coalition fighting for hetman Herman Skoropadsky has been defeated by Petlyura's pro-Soviet Rada, portending dark days for the title family of Imperial Russian military officers. He also wrote a play showing the difficulties in getting *Tartuffe* produced. For 10 points, name this author of the plays *Bliss*, *Adam and Eve*, *A Cabal of Hypocrites*, and *Days of the Turbins*, who also wrote novels such as *The Master and Margarita*.

ANSWER: Mikhail Afanasyevich **Bulgakov**

019-13-64-13101

2. The outline of a defensive wall around this city is now marked by the path of its Circular Road. Some men in this city were ordered to crawl along one street as retribution for an assault on Marcella Sherwood. Originally named Ramdasapur, this city was built on land granted by Akbar. Following one event in this city, Arun Shridhar Vaidya was assassinated by Harjinder Jinda and Sukhdev Sukha. Renamed after its "Pool of Nectar", this city is the site of the "Martyrs' Well" at Jallianwalla Bagh Park. An event at that park was investigated by the Hunter Commission and led Tagore to renounce his knighthood. A massacre in this city led to the dismissal of Reginald Dyer. Two bodyguards shot Indira Gandhi after she ordered Operation Blue Star to proceed in this city. For 10 points, name this Punjab city, the site of a 1919 massacre as well as a sacred golden Sikh temple.

ANSWER: **Amritsar**

149-13-64-13102

3. At one shrine in this city, a ray of light falls on the word LOVE on the Stone of Remembrance at eleven AM on the eleventh day of November every year. A unique public space in this city is Federation Square. The St. Patrick's Cathedral in this city is a prominent example of the Gothic Revival style and was designed by William Wardell. The Maribyrnong River is located quite near the Flemington Racecourse of this city, which hosts its country's premier thoroughbred event. This city's oldest railway station features bright yellow bricks and is the Flinders Street Station. Fender Katsalidis Architects is located in this city and designed its tallest building, the apartment complex Eureka Tower. This city's business district contains the Rialto Towers, which is located on Collins Street. This city's Royal Botanic Gardens are located on the Yarra River and it stretches to the mouth of Port Phillip Bay. For 10 points, identify this capital of the state of Victoria and second-largest city in Australia.

ANSWER: **Melbourne**

066-13-64-13103

4. This opera opens and closes with a frame narrative in which a character who refused to overturn a court martial comes to peace with his failings, and that man declares that another has been “struck down by the Angel of God!” E. M. Forster wrote the libretto for this opera, and a 1960 revision cut this work from four acts to the now-standard two. Dansker’s offer of a mutiny to save one character is turned down in this work. The title figure of this opera is nicknamed “Baby” after he is horrified by the sight of a man that has been whipped, and before his death declares “Starry Vere, God Bless You!” For 10 points, name this opera by Benjamin Britten based on a work by Herman Melville.

ANSWER: **Billy Budd**

002-13-64-13104

5. This thinker claimed that knowledge of one's own mental state, the mental states of others, and the external world must "rise and fall" together in a book claiming that shared linguistic understanding is a necessary condition for objectivity, *Three Varieties of Knowledge*. He claims that all theories about the actions of others will "find them consistent believers of the truths and lovers of the good" in his "principle of charity." An early book by this man states that belief-desire pairs are the combinations of propositional attitudes that constitute both the reasons and causes of actions. He proposed that, while all thought and action must be describable as physical events, there are no universal laws which can predict thought on the basis of physics, in his paper "Mental Events." For 10 points, name this author of "Radical Interpretation" who formulated the theory of anomalous monism.

ANSWER: Donald **Davidson**

019-13-64-13105

6. This album feature the singer exhorting for the "king of second chances" to be thrown into a fire, and a scream of "These are my famous last words!" open this album's song "Bridge Burning". One song on this album claims that "you ran away, you ran away, it was right on cue," and that the title figure is "part of me". Another song on this album states that "My sweet Virginia, you're the same as you were in my arms," and asks "fame, fame, go away, come again some other day!". In addition to the songs "Dear Rosemary" and "Arlandria", this album features a song where the singer is "getting good at starting over". For 10 points, name this seventh and final studio album by the Foo Fighters, which includes the singles "Walk" and "Rope".

ANSWER: **Wasting Light**

002-13-64-13106

7. These compounds are formed by the disproportionation of nonenolizable aldehydes in the presence of aluminum or sodium alkoxide. Although not named for Hunsdiecker, another reaction used to create these compounds was modified to use lead tetra-salts of carboxylic acids, instead of silver salts of carboxylic acids, and involves heating those salts with iodine. Ketones or cyclic ketones can be oxidized to these compounds and the cyclic form of these compounds with the use of peracids, such as mCPBA. These compounds can be produced by refluxing carboxylic acid with an excess of alcohol in the presence of an acid catalyst. That cyclic form of these compounds are lactones. Those mentioned reactions are named for Tishchenko, Birnbaum and Simonini, Baeyer and Villiger, and Fischer. For 10 points, identify these organic compounds that have a fruity smell.

ANSWER: **ester**

066-13-64-13107

8. An old man and a young woman hold hands while surrounded by dead birds in this artist's *The Ill-Matched Couple*. Mary wears a veil as she holds the infant Jesus in this man's *Madonna Under the Fir Tree*. One title figure reaches back to hold back her child in this man's *Venus and Cupid*. This man signed his work by depicting a winged snake carrying a ring in its mouth. This ancestor of three Polykarp Leysers and Goethe shares feast days with Albrecht Durer in both the Episcopal and Lutheran churches, and begged for the release of a Prince captured at the Battle of Muhlberg. One painting by this man features a large party in a boat as deer are chased across a river. For 10 points, name this painter of *The Stag Hunt of the Elector Fredrick the Wise*.

ANSWER: Lucas **Cranach the Elder**

002-13-64-13108

9. After skipping a gig at the Green Mill Cocktail Lounge in this city, Joe Lewis had his tongue cut out. That action was carried out by Jack McGurn, who worked in this city. Vincent Drucci's boss, Hymie Weiss, was killed in front of Holy Name Cathedral in this city. Gangsters in this city included "Gorilla Al" Weinshank and "Tight Lips" Gusenberg, both of whom worked for the protégé of Dion O'Banion. It is not St. Louis, but members of Egan's Rats may have helped some gangsters from this city dress up as policemen and kill seven people in the St. Valentine's Day Massacre. For 10 points, name this city that "Bugs" Moran and a man nicknamed "Scarface", Al Capone, operated out of during Prohibition.

ANSWER: **Chicago**, Illinois

149-13-64-13109

10. At the beginning of this story, two characters carry out a conversation interrupted several times by their reluctance to drink some apparently disgusting tea. The penultimate sentence of this story is "they didn't walk back to the house; they raced;" the final sentence tells us who won. One character in this story combines "Taps" and "Reveille" into a weird bugle call and manages to get her son to cry by tossing him a keychain, even though the boy clearly sees through her charade of pretending to be an admiral. In this story, one character is upset that the maidservant Sandra called her mistress's husband "a big sloppy kike;" but when asked to define "kike," he says "It's one of those things that go up in the air." For 10 points, name this story in which Boo Boo consoles her son Lionel, who runs away to the title watercraft, one of the *Nine Stories* by J.D. Salinger.

ANSWER: "**Down at the Dinghy**"

020-13-64-13110

11. During this monarch's reign, Sir Cavagnari negotiated the Treaty of Gandamak, which was proceeded by Cavagnari's murder and this monarch's forces engaging in the Siege of the Sherpur Cantonment. This ruler was advised by Baron von Stockmar and kicked a person out of the court for impregnating Flora Hastings. John Newman attempted to show that the Anglican Church's doctrines matched those of the Roman Catholic Church during this monarch's reign. A person refused to form a ministry if this ruler's attendants were not changed, in what became known as the Bedchamber Crisis. John Frost led the Newport Riots during this monarch's reign as part of the Chartist movement. This queen was the target of the Jubilee plot. For 10 points, name this British Queen who was declared "Empress of India" by Disraeli.

ANSWER: Queen **Victoria**

149-13-64-13111

12. In one novel by this author, Dionisio moves from Cieneguilla in a failed attempt to invest Conchita's fortune. In another of his novels, Procopio Vasquez is reduced by his son-in-law Pascual's alliance with corrupt officials, and a well-off household from Zacatecas must survive on an office salary in Mexico City. In another novel by this member of the "Golden Boys," women persistently name-drop General Malacara in an attempt to impress a doctor riding a train and then to acquire money and passes from Pancho Villa. He also wrote about the fall of Indian farmer Demetrio Macias. For 10 points, name this author of the Mexican Revolution who wrote *The Firefly*, *The Trials of a Respectable Family*, *The Flies*, and *The Underdogs*.

ANSWER: Mariano Azueta

019-13-64-13112

13. Sleator and Tarjan introduced a restructuring heuristic for this structure that performs a sequence of rotations after each access; that heuristic is splaying. A common construct used in dynamic programming is the optimal type of this structure, which has minimal expected cost. The expected height for this structure with n keys, when it is randomly built, is $O(\log n)$. The keys of a treap obey this structure's namesake property while the priorities obey the min-heap order property. The namesake property of this structure is that elements in the left subtree of a node are less than the node while elements in the right subtree are greater than the node. An example of the self-balancing type of this structure is the red-black tree. For 10 points, identify this tree that shares its name with a naïve searching algorithm.

ANSWER: binary search tree [prompt on tree]

066-13-64-13113

14. Arnold Bax's fifth symphony was heavily influenced by, and dedicated to, this composer. The first movement of this composer's sixth symphony is based on the stepwise ascendancy of the D Dorian mode, which permeates the whole work. This composer's only mature string quartet is subtitled "Voces intimae". His fourth symphony opens with the notes C-D-F sharp-E; that symphony has a third movement *Il tempo largo* and is quite grim due to its composer's brush with throat cancer. This composer saw the symphony as a musical process in which "profound logic" connects the motifs, whereas Mahler thought it "must be like the world". Willy Burmester vowed to never play this composer's D minor violin concerto after two versions were premiered without him. His seventh symphony is remarkable for only having one movement. For 10 points, identify this composer of many tone poems based on the *Kalevala*, as well as *Finlandia*.

ANSWER: Jean Sibelius [or Johan Julius Christian Sibelius]

066-13-64-13114

15. Propagating examples of this phenomenon include Luder's bands and the Portevin-Le Chatelier effect, which are differentiated by being smooth and discontinuous. Since the transition to this phenomenon is sometimes hard to determine, it can be found by drawing a line offset by 0.2% from the origin of a certain graph, with a slope equal to Young's modulus. The transition to this phenomenon is marked by a sudden decrease in stress. Ductile materials can experience a lot of this phenomenon before fracture, and it occurs when atoms are displaced and a material cannot return to its original shape. For 10 points, identify this type of deformation that takes place beyond the yield point, unlike elastic deformation.

ANSWER: plastic deformation [or plasticity; or inelastic deformation; or permanent deformation; or tensile deformation; or yielding before "yield point" is read; prompt on deformation; do not accept "elastic deformation"; do not accept "fracture"; do not accept "fatigue"]

066-13-64-13115

16. In 2011, this religious group's Canadian branch withdrew from its worldwide body over plans to open membership to women and people outside of professional occupations. This organization was the subject of 1993's *Berger v. Rensselaer* case. It was founded by William Knights, Samuel Hill, and John Nicholson in Janesville, Wisconsin in 1899 after the three repeatedly met each other on their sales routes. Products from this group are color-coded by audience, including white versions for medical workers and red versions for schools. A pitcher with two handles and a torch is the logo of this organization, in allusion to its namesake's victory over the Midianites. For 10 points, name this Protestant society that has placed over a billion Bibles in hotel rooms.

ANSWER: Gideons International

019-13-64-13116

17. This author chronicled purported occultists in his *Lives of the Necromancers* and wrote a novel inspired by the long-undiscovered murderer Eugene Aram, *Deloraine*. He derived the plot and the subtitle from separate works of Henry Mackenzie in his *Fleetwood*. In a novel by this man, the title character develops a rivalry with Gines while a member of a gang of thieves and learns that when Emily Melville was saved from a fire, Barnabas Tyrrel grew so tyrannical that Ferdinando Falkland eventually killed him. This author of a four-volume 1820s history of England advocated the total dissolution of government and the coming of a future utopia based on the reason of free peoples in his controversial *Enquiry Concerning Political Justice*. For 10 points, name this author of *Caleb Williams* who initially resisted social pressure to marry Mary Wollstonecraft when she was pregnant with his daughter Mary Shelley.

ANSWER: William Godwin

019-13-64-13117

18. At one battle in this country, artillery shells were transported by the bear Wojtek. At that battle, in this country, the attacking side tried to break through the Gustav Line, while under the command of Harold Alexander. M. W. Williamson led the initial attack of six Swordfish against this country's moored fleet at one battle. Admiral Cunningham and Lumley Lyster commanded British troops against this country during the first ship-to-ship naval engagement that only involved aircraft, which was the Battle of Taranto. As part of Operation Shingle in this country, John Lucas established a beachhead near Anzio. A full scale invasion of this country followed Operation Husky. For 10 points, name this country where the Allies won the Battle of Monte Cassino and captured Rome during World War II.

ANSWER: Italy

149-13-64-13118

19. Archaic forms of this case evolved into the adverbs for "yesterday," "today," and "tomorrow;" "pridie," "hodie," and "postridie." The word for "military service" can sometimes take this case when found in expressions with other words normally found in this case. One category of words that can take this case involves islands that have only one town on them. The countryside, the ground, and "home" are other words which can exist in this case. In first and second declension singular nouns, this case is identical to the genitive form; in other situations, it is identical to the ablative form. For 10 points, identify this rarely used classical Latin noun case, most frequently found when someone is "at Rome," which marks the survival of a Proto-Indo-European case expressing the "place where" property of a noun.

ANSWER: Latin locative case

019-13-64-13119

20. These proteins are divided into families based on the structure of their CRD. A commonly used one of these proteins is concanavalin A and, in animals, they act like velcro to link cells together. Proteins with a collagen-like region and a region similar to these proteins play an important role in the innate immune system, such as the mannan-binding one. The influenza virus uses one of them to bind to sialic acid. A heterodimer that consists of an enzyme that inhibits protein synthesis and one of these proteins is ricin, which was discovered when an extract of castor beans agglutinated red blood cells. One isolated from bananas is a potent inhibitor of HIV replication. For 10 points, identify this class of proteins that binds carbohydrates and really likes sugars.

ANSWER: **lectins** [or phyto**hemagglutinins**; or **phytagglutinins**; prompt on **glycan-binding** protein; prompt on **GBP**; prompt on **agglutinins** before "agglutinated" is read]

066-13-64-13120

21. In examining a yeast analogue of the first enzyme in this pathway, T. A. Steiz, et al. found some of the first direct evidence for the induced fit hypothesis. It features a rare example of a feedforward activator in a molecule sometimes called a Harden-Young ester. Mutations in the GALT gene, which encodes a uridylyltransferase, prevents one molecule from being degraded and entering this pathway. That molecule is degraded by the Leloir pathway. The tracer ¹⁸F-FDG is metabolized by this pathway, which allows the detection of cancer cells with PET. The enzyme aldolase in this pathway produces both DHAP and G3P. It is part of a well-known futile cycle, controlled by fructose 2,6-bisphosphate, with gluconeogenesis. The first enzyme in this pathway is hexokinase I, and it yields two net ATP, two NADH and two pyruvate. For 10 points, identify this ten step pathway for the breaking down of glucose.

ANSWER: **glycolysis** [or **EMP** pathway; or **Embden-Meyerhof-Parnas** pathway; or **Entner-Doudoroff** pathway]

066-13-64-13121



1. Throughout this novel, Felicite attempts to destroy the title character's files on heredity research, believing that the information will scandalize her family. For 10 points each:

[10] Name this 1893 novel that ends with the title character marrying his niece Clotilde.

ANSWER: Doctor Pascal [or *Le Docteur Pascal*]

[10] In this other novel, the laundrywoman Gervaise marries Coupeau after visiting the Louvre, and gives birth to Nana, before Coupeau ironically falls off the roof of a hospital and becomes an alcoholic.

ANSWER: *L'Assommoir* [or *The Dram Shop*; or *The Drinking Den*]

[10] *Doctor Pascal* and *L'Assommoir* are two novels in the Rougon-Macquart series, which also includes *Nana* and *Germinal* and was written by this author of the open letter "J'Accuse!"

ANSWER: Emile Zola

019-13-64-13201

2. This group runs the "Partnership for Peace" program. For 10 points each:

[10] Name this military alliance, centered in Brussels, which was formed during the Cold War. It was opposed by the Warsaw Pact.

ANSWER: NATO [or North Atlantic Treaty Organization]

[10] This man served as the first Secretary General of NATO. He claimed that NATO was formed to "keep the Americans in, the Russians out, and the Germans down."

ANSWER: Hastings Ismay, 1st Baron Ismay

[10] This 1983 NATO exercise, which simulated DEFCON 1 readiness, scared the bejeebies out of the Soviets, possibly causing them to begin arming their nuclear weapons.

ANSWER: Able Archer 83

149-13-64-13202

3. Like temperature and pressure, this variable is an intensive parameter. For 10 points each:

[10] Identify this variable, important in describing multicomponent systems, that can be derived as the partial molar derivative of Gibbs free energy.

ANSWER: chemical potential

[10] This classification of phase transitions is based on the continuity of derivatives of the chemical potential with respect to temperature and pressure.

ANSWER: Ehrenfest classification

[10] The Gibbs-Duhem relation states that the sum over all components of the number of moles times the increase in chemical potential is equal to the negative of entropy times change in temperature plus this quantity times change in pressure. For one mole of an ideal gas, this quantity is 22.4 liters.

ANSWER: volume

066-13-64-13203

4. Gwen Verdon refined and formalized this person's namesake style. For 10 points each:

[10] Name this dancer and choreographer who starred in *Billion Dollar Baby* and choreographed *The Pajama Game*.

ANSWER: Bob **Fosse**

[10] Bob Fosse choreography for "Damn Yankees" was inspired in part by the work of this "father of theatrical jazz dance" that choreographed the "Diamonds Are a Girl's Best Friend" sequence in *Gentleman Prefer Blondes*.

ANSWER: Jack **Cole** [or John Ewing **Richter**]

[10] Jack Cole also choreographed this Sondheim-penned musical in which the slave Pseudolus seeks his freedom.

ANSWER: "**A Funny Thing Happened on the Way to the Forum**"

002-13-64-13204

5. One figure of this name agrees to a favor in return for marriage to the nymph Deiopea. For 10 points each:

[10] Give this name shared by the often-conflated sons of Poseidon, Hippiotes, and Hellen.

ANSWER: **Aeolus**

[10] One later source for the wind god Aeolus holds that he sent this daughter of his a sword with which to kill herself after learning that she had committed incest with her brother Macareus.

ANSWER: **Canace**

[10] One Aeolus was the father of this king of Boetia, whose children were saved from their stepmother by a creature sent by their mother Nephele.

ANSWER: **Athamas**

105-13-64-13205

6. This man collaborated with his wife Brenda Braithwaite on the social networking game *Ravenwood Fair*. For 10 points each:

[10] Name this long-haired id Software co-founder, who once promised to "make you his bitch" in an ad for his much-hyped, yet awful game *Daikatana*.

ANSWER: John **Romero** [or Alfonso John **Romero**; accept John **rome.ro**]

[10] Romero was coasting off the success of his involvement in many of id's projects, such as *Wolfenstein 3D*, *Quake*, and this other horror first-person shooter in which you play a space marine who works his way up from a simple pistol to the BFG 9000.

ANSWER: **Doom**

[10] Before Romero became a developer, he idolized Jordan Mechner for producing this beat-em-up game, which was remade in 2012. Its hero assumes a fighting stance and fights wave after wave of enemies inside Akuma's fortress.

ANSWER: **Karateka**

020-13-64-13206

7. This ancient city is located near the Bay of Naples and contains the Trellis House. For 10 points each:

[10] Name this city that was buried along with Pompeii by the eruption of Vesuvius.

ANSWER: **Herculaneum** [or **Ercolano**]

[10] This building at Herculaneum was first excavated by Karl Weber. It is best known for its extensive library.

ANSWER: **Villa of the Papyri** [or **Villa dei Papiri**]

[10] House Number 22 at Herculaneum is known for containing this type of Roman dining room. These rooms contained three klinai arranged around a square table.

ANSWER: **triclinium**

149-13-64-13207

8. This author wrote about Diamond, who goes to find the street-sweeper Nanny in *At the Back of the North Wind*. For 10 points each:

[10] Name this influential Victorian fantasy author who created Anodos and the Marble Lady in *Phantastes* and depicted Irene and Lutie repelling the title creatures with song in *The Princess and the Goblin*.

ANSWER: George **Macdonald**

[10] This man published his first novel at Macdonald's encouragement after previewing the novel with Macdonald's children. The White Rabbit and the Queen of Hearts appear in that novel by this man, who also wrote poetry about "The Hunting of the Snark" and "The Walrus and the Carpenter."

ANSWER: Lewis **Carroll** [or Charles Lutwidge **Dodgson**]

[10] Macdonald appears as the guiding Vergil figure in this insane theological tract by C.S. Lewis, which depicts hell as a large meadow in which the blades of grass are grey-colored and extremely heavy, but the "ghosts" who live there can take a bus to get to heaven at any time.

ANSWER: *The **Great Divorce***

019-13-64-13208

9. This genus of green algae has two cell types: somatic cells, which swim and keep the algae in light, and gonidia, which are responsible for reproduction. For 10 points each:

[10] Identify this genus used to study the evolution of multicellularity due to its close relation to the unicellular *Chlamydomonas* genus.

ANSWER: **Volvox**

[10] By comparing this thing of closely related unicellular and multicellular organisms, one can identify genes that may have given rise to multicellularity. This thing is an organism's complete genetic material.

ANSWER: **genome**

[10] The Institute for Genomic Research and its successor, Celera Genomics, both founded by Craig Venter, used this sequencing technique in which DNA is shredded into smaller fragments, sequenced individually, and the sequences assembled based on overlap.

ANSWER: whole genome **shotgun** sequencing

066-13-64-13209

10. Two men play guitars next to a man who appears to have fallen asleep somehow. For 10 points each:

[10] Name this painting that had a single figure extracted from it for its artist's painting *Spanish Dancer*.

ANSWER: **El Jaleo**

[10] This artist of *El Jaleo* caused a scandal with his depiction of Virginie Gautreau and mocked one of his own paintings as "Damnation! Silly, Silly Pose".

ANSWER: John Singer **Sargent**

[10] In this Sargent painting, the title group stands in the tidal pools, ready to catch themselves a delicious seafood dinner. Two women with baskets converse, while an older woman looks down at a child.

ANSWER: **Oyster Gatherers at Cancale**

002-13-64-13210

11. This poem says that the title concept "has her sovereign shrine, though seen of none save him whose strenuous tongue, can burst Joy's grape against his palate fine." For 10 points each:
[10] Name this poem, originally published alongside "Lamia" and "The Eve of St. Agnes," which mentions an eponymous kind of fit that "shall fall sudden from heaven like a weeping cloud."

ANSWER: "**Ode on Melancholy**" [do not accept "Ode to Melancholy"]

[10] This author of "Endymion" and *Hyperion* wrote "Ode on Melancholy."

ANSWER: John **Keats**

[10] The mood of the poem is set by the repeated use of this letter, which appears five times in the first five words.

ANSWER: "**o**"

019-13-64-13211

12. This man's economic policy was dictated by the Chicago Boys. For 10 points each:

[10] Name this military leader of Chile who overthrew Salvador Allende in a coup.

ANSWER: Augusto Jose Ramon **Pinochet** Ugarte

[10] This report, ordered by Patricio Aylwin, investigated human rights abuses under the Pinochet regime. Its namesake had been an ambassador of Salvador Allende.

ANSWER: **Rettig** Report [or The **National Commission for Truth and Reconciliation** Report]

[10] Manuel Contreras served as the head of this organization under Pinochet. Separated from the army by Decree 521, this group used the Colonia Dignidad as a torture center.

ANSWER: **DINA** [or **Direccion de Inteligencia Nacional**; or **National Intelligence Directorate**]

149-13-64-13212

13. This method is based on the fact that the expectation value of the Hamiltonian for any normalized wave function whatsoever is greater than or equal to the ground state. For 10 points each:

[10] Identify this method that can be adapted to find bounds for excited states but normally involves minimizing a namesake parameter for a wave function to find the ground state.

ANSWER: **variational** method [or **variational** principle]

[10] The numerical technique named for the density matrix and this technique is an example of the variational method within the set of matrix-product states. Kenneth Wilson names a formulation of it and a functional form of it expresses mode elimination in terms of formally exact functional differential equations.

ANSWER: **renormalization group** [or **RG**]

[10] The BCS theory of this phenomenon is based on the variational method.

ANSWER: **superconductivity**

066-13-64-13213

14. When these things are isolated and attracting, they are called limit cycles and a collection of all of them is plotted in a phase portrait. For 10 points each:

[10] Identify these solutions to differential equations that are paths in the phase plane.

ANSWER: periodic **orbits** [or closed **orbit**; prompt on closed periodic **trajectory**]

[10] This theorem states that if the positive semiorbit of a point is bounded and the omega-limit set of that point contains no critical points, then the omega-limit set is a periodic orbit. It can also be stated as orbits will either go to a limit cycle or fixed point in two dimensions.

ANSWER: **Poincaré-Bendixson** theorem

[10] This type of differential equation contains functions that depends on only one independent variable, unlike partial differential equations, which contain multivariable functions.

ANSWER: **ordinary** differential equation [or **ODE**]

066-13-64-13214

15. This philosopher wrote against occultism in *The Game of Tarot* and made the claim that all philosophy before the late nineteenth century is meaningless due to an over-concern with epistemology. For 10 points: [10] Identify this mathematical intuitionist ordinary language philosopher, who wrote *Truth and Other Enigmas* and *The Seas of Language*.

ANSWER: Michael **Dummet**

[10] Dummet identifies this man as the first meaningful philosopher in his book on him subtitled *Philosophy of Language*. This man wrote *The Foundations of Arithmetic* in 1884.

ANSWER: Gottlob **Frege**

[10] In 1993, Dummet penned a book of this kind; another influential book of this type was written by Kate Turabian. A noted example of this kind of book is full of nonsensical ideas about avoiding split infinitives and incorrectly identifies 75% of its examples of the passive voice.

ANSWER: a **manual of style** [or equivalents]

019-13-64-13215

16. This phenomenon is the manifestation of search theory in the labor market. For 10 points each:

[10] Identify this type of unemployment which moves the Beveridge curve outwards and represents unemployment from workers moving between jobs.

ANSWER: **frictional** unemployment

[10] The idea of frictional unemployment as a problem of communicating data about job openings was introduced in this economist's "Information in the Labor Market." This coiner of the term "regulatory capture" developed an economically optimal diet that met all nutritional requirements for thirty-nine dollars a year.

ANSWER: George **Stigler**

[10] Stigler disputed with his student Gregg Jarrell over the role of regulation in the price of this thing. The "dark spread" and "clean spread" are types of producer margin in this market, whose producers are incentivized to positive externalities by a feed-in tariff.

ANSWER: **electricity** [or **electric power** generation, etc.]

019-13-64-13216

17. Fredrik Ullén could be the first person to completely record this composer's *Études transcendantes* (100). For 10 points each:

[10] Identify this Parsi composer of "marathon-length large-scale piano epics" like *Opus clavicembalisticum* and his *Piano Sonata no. 4*.

ANSWER: Kaikhosru Shapurji **Sorabji**

[10] Most of Sorabji's music unusually uses at least three, and in some cases as many as seven, of these things. These things have five lines and four spaces, each of which represents a specific pitch.

ANSWER: **staff** [or **staves**]

[10] Sorabji wrote a number of works in this genre, including *Djâmi*. This genre was originated by John Field.

ANSWER: piano **nocturne**

066-13-64-13217

18. After many Kentucky militiamen failed to arrive armed to this battle, the American general stated that it was the first time he'd seen a Kentuckian "without a gun, a pack of cards, and a jug of whiskey." For 10 points each:

[10] Name this battle in which the Laffite brothers helped an American defeat Edward Pakenham at Chalmette Plantation. The British attack on the western flank at this battle was led by Colonel Thornton.

ANSWER: Battle of **New Orleans**

[10] The Battle of New Orleans occurred after the signing of this treaty, which ended the War of 1812. Fort Bowyer was also captured by the British following the signing of this treaty.

ANSWER: Treaty of **Ghent**

[10] Jackson used this watercourse as his forward defensive position. In order to cross this barrier, Pakenham ordered his troops to throw sugarcane into the moat and that assault was led by Thomas Mullins.

ANSWER: **Rodriguez Canal**

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19. Let's examine Henry James's relationship with Europe, as seen through his writings, for 10 points each.

[10] In his travel writings, James spoke favorably of this city, where he composed the bulk of *Roderick Hudson*. George Emerson and Lucy Honeychurch first meet as tourists in this city in *A Room with a View*.

ANSWER: **Florence** [or **Firenze**]

[10] Critics suppose that the cheeriness of this novel's English setting had more to do with James's crush on Oscar Wilde. At any rate, it focuses on the aesthetes Nick Dormer and Miriam Rooth.

ANSWER: *The* **Tragic Muse**

[10] James was less impressed with this French landmark, where Christopher Newman sits, exhausted, as he is approached by Noemie Nioche at the beginning of *The American*.

ANSWER: Musee de **Louvre** [or **Louvre** Museum]

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20. Tocks Island is located just upstream of this geographic feature and was the subject of a hugely controversial proposed dam. For 10 points each:

[10] Identify this opening in the Appalachians between Pennsylvania and New Jersey that is cut through by a namesake river and bordered by Mounts Tammany and Minsi.

ANSWER: **Delaware** River **Water Gap** [prompt on The **Gap**]

[10] The Delaware Water Gap is crossed by Interstate 80, which closely approximates the routes of many historic roads or trails, including this one that ended in Willamette Valley in the namesake state.

ANSWER: **Oregon** Trail

[10] The Delaware River appropriately empties into the Delaware Bay, whose boundary with the Atlantic is marked by these two capes, one of which is connected to the city of Lewes in Delaware. Name either.

ANSWER: Cape **Henlopen** and Cape **May**

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21. This model organism is unusual for having non-LTR retrotransposable elements at the end of chromosomes instead of repeats. For 10 points each:

[10] Identify this model organism whose salivary glands contain polytene chromosomes.

ANSWER: *Drosophila melanogaster* [or *Drosophila melanogaster*]

[10] Sometimes described as "A *Drosophila* for the plant kingdom", this model organism can be efficiently transformed by spraying its flowers with *Agrobacterium tumefaciens*.

ANSWER: *Arabidopsis thaliana* [or *Arabidopsis thaliana*; or thale cress; or mouse-ear cress]

[10] TILLING, a reverse genetic method originally developed for *Arabidopsis*, usually uses this mutagen to rapidly introduce point mutations to a lot of genes. It usually causes methylation of guanine residues and is used in a namesake screen.

ANSWER: EMS [or ethane methanesulfonate; or ethane methyl sulfonate; or methanesulfonic acid ethyl ester]

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